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LONG RANGE SEISMIC MEASUREMENTS

TAN

3 JUNE 1966

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

31 OCTOBER 1966

By

EARTH SCIENCES DIVISION

TELEDYNE INDUSTRIES, INC.

Under

Project VELA UNIFORM

Sponsored By

ADVANCED RESEARCH PROJECTS AGENCY

Nuclear Test Detection Office

ARPA Order No. 624

DISCLAIMER NOTICE

LONG RANGE SEISMIC MEASUREMENTS

TAN

3 June 1966

SEISMIC DATA LABORATORY REPORT NO. 169

AFTAC Project No.:	VELA T/6702
Project Title:	Seismic Data Laboratory
ARPA Order No.:	624
ARPA Program Code No.:	5810
Name of Contractor:	EARTH SCIENCES DIVISION TELEDYNE INDUSTRIES, INC.
Contract No.:	AF 33(657)-15919
Date of Contract:	18 February 1966
Amount of Contract:	$ 1,842,884
Contract Expiration Date:	17 February 1967
Project Manager:	William C. Dean (703) 836-7644

P. O. Box 334, Alexandria, Virginia

AVAILABILITY

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This research was supported by the Advanced Research Projects Agency, Nuclear Test Detection Office, under Project VELA-UNIFORM and accomplished under the technical direction of the Air Force Technical Applications Center under Contract AF 33(657)-15919 .

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TAN

EVENT DESCRIPTION

DATE: 3 June 1966

TIME OF ORIGIN: 14:00:00.0Z

YIELD:

MAGNITUDE: 5.56 ± 0.49

LOCATION:

SITE: Nevada Test Site, Area U7k

GEOGRAPHIC COORDINATES:

Lat: 37°04'06.0" N

Long: 116°02'07.0" W

ENVIRONMENT:

GEOLOGIC MEDIUM: Tuff

SURFACE ELEVATION: 4070 ft.

SHOT ELEVATION: 2230 ft.

SHOT DEPTH: 1840 ft.

COMPUTED EPICENTER: ALL STATIONS

GEOGRAPHIC COORDINATES:

Lat: 36°59'45.6" N

Long: 116°04'48.0" W

TIME OF ORIGIN: 14:00:04.8Z

DEPTH: 46.9 km

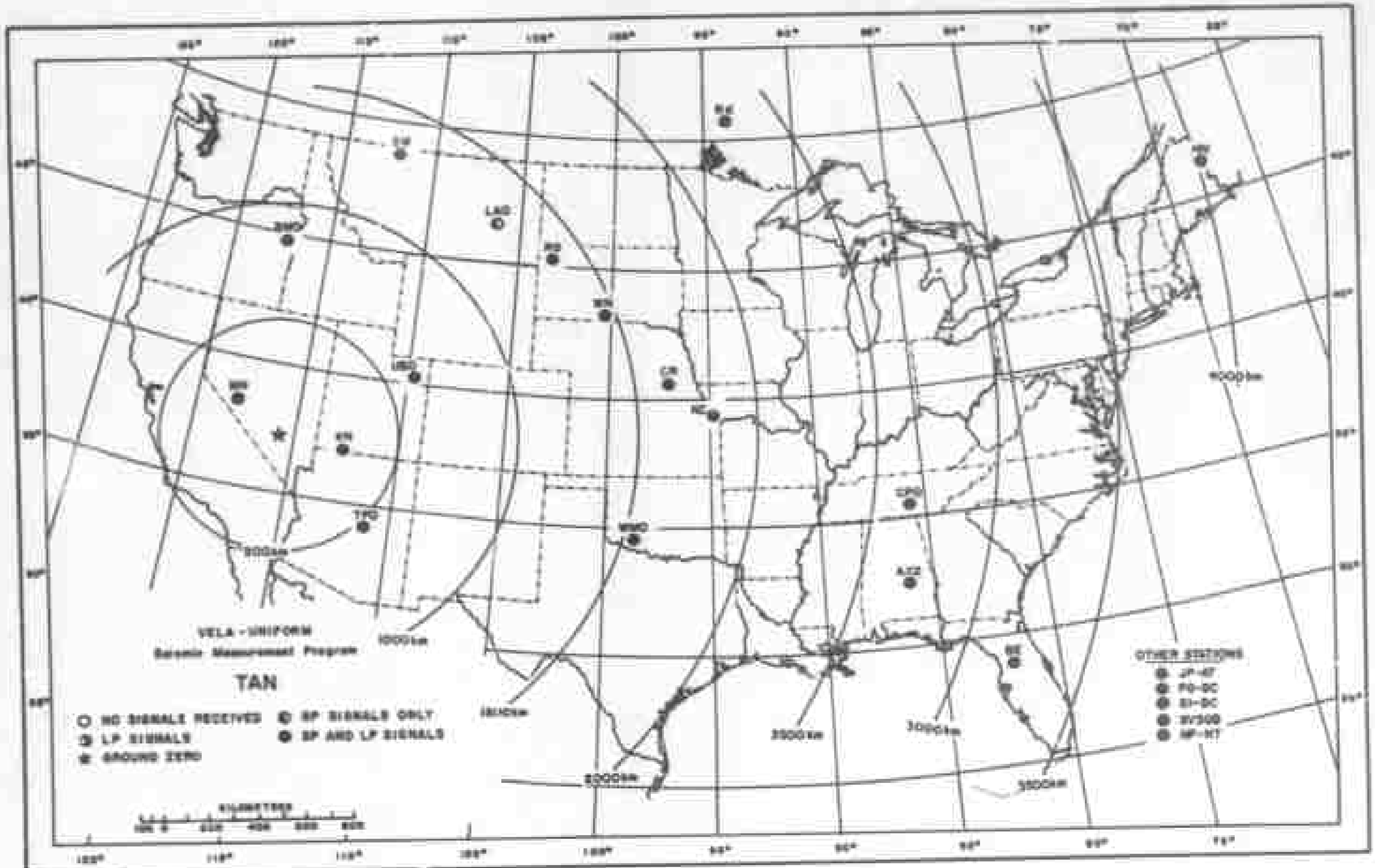
EPICENTER SHIFT: 9.0 km, S 26° W

Code	Station	SPZ	SPR	SPT	LPZ	LPR	LPT	Tape	Timing
		Final							
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	P
KN-UT	Kanab, Utah	+	+	+	+	+	+	*	P
TFSO-Z1	Tonto Forest Observatory, Arizona	+	+	+	+	+	+	*	P
UBSO-Z10	Uinta Basin Observatory, Utah	+	+	+	+	+	+	*	P
BMSO-Z3	Blue Mountain Observatory, Oregon	+	+	+	+	+	+	*	P
LAO	Subarray AO-10, Montana	+	N	N	N	N	N	*	P
SW-MA	Sweetgrass, Montana	+	+	+	+	+	+	*	P
RG-SD	Redig, South Dakota	+	+	+	+	I	+	*	P
WN-SD	Winner, South Dakota	+	+	+	+	+	+	*	P
WMSO-Z6	Wichita Mountain Observatory, Oklahoma	+	+	+	+	+	+	*	P
CR-NB	Crete, Nebraska	+	+	+	+	+	+	*	P
JP-AT	Jasper, Alberta, Canada	+	+	+	+	+	+	*	P
KC-MO	Kansas City, Missouri	+	+	+	+	+	+	*	P
PG-BC	Prince George, British Columbia, Canada	+	+	+	+	+	+	*	P
SI-BC	Smithers, British Columbia, Canada	+	+	+	+	+	+	*	P
RK-ON	Red Lake, Ontario, Canada	+	+	+	+	+	+	*	P
CPSO-Z8	Cumberland Plateau Observatory, Tennessee	+	+	+	+	+	+	*	P
AX2AL	Alexander City, Alabama	+	+	+	+	+	+	*	P
BE-FL	Belleview, Florida	+	-	-	+	+	+	*	P
HN-ME	Houlton, Maine	+	+	+	+	+	+	*	P
SV3QB	Schafferville, Quebec, Canada	+	+	+	+	+	I	*	P
MP-NT	Mould Bay, Northwest Territories, Canada	+	+	+	+	+	+	*	P

I Inoperative
N No Instrument
P Primary Timing
+ Signal
- No Signal
* Magnetic Tape Available

Station Status Report - JAN

Table 1



Recording Stations and Signals Received

Figure 1

INTRODUCTION

A long range seismic measurements (LRSM) program and several larger seismographic observatories were established under VELA-UNIFORM to record seismological data resulting from natural seismic activity and a planned series of U. S. underground nuclear tests. The LRSM teams are mobile and occupy locations selected to provide optimum data from events of special interest; the observatories are permanent installations as follows:

Wichita Mountains Seismological Observatory (WMSO)
Lawton, Oklahoma

Uinta Basin Seismological Observatory (UBSO)
Vernal, Utah

Blue Mountain Seismological Observatory (BMSO)
Baker, Oregon

Cumberland Plateau Seismological Observatory (CPSO)
McMinnville, Tennessee

Tonto Forest Seismological Observatory (TFSO)
Payson, Arizona

Large Aperture Seismic Array (LASA)
Billings, Montana

The purpose of this report is to provide an analysis of data resulting from the TAN event recorded by the LRSM

teams and the VELA observatories and a preliminary summary of data reported by other permanent and temporary seismographic stations.

INSTRUMENTATION AND PROCEDURE

The instrumentation at each of the LRSM locations consists of three-component short-period and three-component long-period seismographs. In general, data are recorded on 35 millimeter film and on one-inch 14 channel magnetic tape although recently more portable instrumentation has been incorporated which records only on magnetic tape. The stations are all equipped to record WWV continuously to provide accurate time control and calibration is accomplished once each day and just prior to each shot at the operational settings. Pertinent information useful for analysis of LRSM data is available to qualified users of this data and is contained in Technical Report 65-43, "Interpretation and Usage of Seismic Data, LRSM program." General information on LRSM van and portable system equipment and operation is given in Technical Reports 66-27, "The LRSM Mobile Seismological Laboratory," and 65-74, "A Portable Seismograph." Copies of these reports may be obtained from DDC. The AD control number of Technical Report 66-27 is 480343. All the observatories have both long-

period and short-period, three-component instrumenation, in addition to their other specialized facilities.

Station information is presented in Appendix I. This includes the station name and code; the geographic coordinates, distances and azimuths involved; the station elevations; and the type of instruments in use at each location. Representative instrumental response curves are shown in Appendix II(B).

The procedures used in measuring amplitudes reported herein is illustrated in Appendix II(A) and the unified magnitude is calculated as shown in Appendix I(B). The distance factors (B) beyond 16^{o} are from Gutenberg and Richter*. For distances less than 16^{o} values were read from a curve in the Gutenberg and Richter paper back to 10^{o} and then extrapolated to 2^{o}, using an inverse cube relationship.

A standard hypocenter location program for a digital computer is used to determine the location using data from all stations analyzed. Best-fit values of latitude, longitude, depth of focus, and time of origin are determined statistically by a least squares technique. This utilizes a

*Gutenberg, B. and Richter, C. F., Magnitude and Energy of Earthquakes, Ann. Geofis., 9 (1956), pp. 1-15

Jeffreys-Bullen travel-time curve as modified by Herrin in 1961 on the basis of Pacific surface-focus recordings. Precision of the computation is limited primarily by the accuracy of arrival times, the validity of the standard travel-time curve, and by local velocity deviations. Since the method is based on P-wave arrivals, this particular program does not make use of later phases such as pP and S in the determination of depth or location.

DATA AND RESULTS (LRSM and VELA OBSERVATORIES)

The parameters of the TAN event and a summary of the seismic evaluation is shown on the Event Description page. The operational status of the 22 LRSM stations and observatories is given in Table 1 and illustrated in Figure 1.

Table 2 summarizes the measurements made of the principal phases from the TAN event at the LRSM and VELA stations. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of Pn or P motion and other phases as seen on the short-period vertical instruments. Long-period Love and Rayleigh wave motion are also tabulated in (A/T) form. In addition, individual station Rayleigh wave areas (mm^2) is indicated as measured on the LPZ only. Although reduced to 1K magnification,

they have not been normalized to any magnitude. Twenty-two stations recorded short-period signals. Long-period signals from this event were recorded by 21 stations.

The unified magnitudes determined from the LRSM and VELA observatories is shown in Figure 2. The average magnitude is 5.56 ± 0.49 .

The travel-time residuals from the Pn and P phases are shown in Figure 3. Figures 4 through 8 illustrate plots of the amplitude of P, Pg, Lg, LQ, and LR.

Attached to the report are illustrative seismograms showing the signals recorded at 4 stations. The most distant station analyzed that recorded TAN was NP-NT at a distance of 4371 kilometers.

Principal Phases
TAN
3 June 1966
14:00:00.08

Code	Station	Distance (km)	Inst.	Magnification (k) Film x 10	Phase	Observed Travel Time (min)	Observed Travel Time (sec)	Period T (sec)	Maximum Amplitude A/T	Magnitude (m)	Area (mm^2) LPZ
MN-NV	Mina, Nevada	240	SPZ	1.27	Pn	0	37.3	0.4	2825	5.73	
			SPR	1.27	e	0	37.9	0.3	3948		
			SPR	1.27	e	0	38.4	0.8	3375		
			SPZ	1.27	Pg	0	39.8	(0.8)	(17431)		
			SPT	0.74	Lg			1.0	18970		
			LPT		LQ			---	---		
			LPR	3.49	LR			13.0	1494		383 90
KN-UT	Kanab, Utah	285	SPR	2.08	Pn	0	42.9	0.5	1653	5.71	
			SPZ	2.08	e	0	44.0	0.8	2627		
			SPZ	0.47*	Pg	0	47.9	0.8	14528		
			SPT	1.5*	Lg			1.0	19000		
			LPT	14.1*	LQ			(9.0)	(819)		
			LPR	4.8	LR			12.0	1393		257 23
TFSO	Tonto Forest Observatory, Arizona	531	SPZ-1	14.7	Pn	1	14.5	0.35	317	5.83	
			SPZ-1	14.7	e	1	15.9	0.55	220		
			LPZ	97.0	e	1	17	20.0	8.7		
			SPZ-1	14.7	(P*)	1	19.1	0.8	233		
			SPZ-1	1.87	Pg	1	27.0	1.2	2409		
			SPZ-1	1.87	e	1	44.8	1.2	1581		
			SPN	1.87	Lg			1.1	1397		
			SPE	1.87	Lg			(1.2)	(1355)		
			LPE	14.0	LQ			(13.0)	(55.8)		
			LPN	15.0	LQ			(13.0)	(42.7)		
			LPZ	5.0	LR			17.0	233		201.00
UBSO	Uinta Basin Observatory, Utah	668	SPZ-10	9.2	Pn	1	33.7	1.2	949	8.58	
			SPZ-10	9.2	e	1	39.5	1.0	544		
			SPZ-10	9.2	(P*)	1	44.2	(1.15)	(295)		
			SPZ-10	21.9*	Pg	1	52.9	1.1	1851		
			LPZ	13.8	e	2	00	22.0	3.7		
			LPN	13.1	e	2	00	22.0	2.6		
			SPN	12.31*	Lg			1.2	2744		
			SPE	4.41*	Lg			1.1	7542		
			LPN	13.1	LQ			19.0	41.7		
			LPE	13.8	LQ			13.0	83.0		
			LPZ	25.0*	LR			(14.0)	(223)		95.37
BMSO	Blue Mountain Observatory, Oregon	871	SPZ-3	(500*)	Pn	1	58.2	(0.7)	(28.9)	(5.40)	
			SPZ-3	(500*)	e	2	00.0	1.0	(84.0)		
			SPZ-3	(500*)	Pg			---	---		
			SPN		Lg			---	---		
			SPE		Lg			---	---		
			LPN	14.5	LQ			18.0	82.9		
			LPE	14.5	LQ			(20.0)	(19.3)		
			LPZ	1.0	LR			14.0	250		195.00
LAO	Subarray AO-10, Montana	1342	SPZ	320	Pn	2	53.1	1.3	45.7	5.75	
			SPZ	30.0	e	2	54.0	1.15	124		
			SPZ	30.0	PP	3	01.4	1.1	94.7		
			SPZ	30.0	e	3	10.5	1.0	188		
			SPZ	30.0	(Pg)	3	41.1	1.1	118		
SW-MA	Sweetgrass, Montana	1343	SPR	188.5	P	2	(58.2)	1.2	134	6.20	
			SPZ	188.5	PP	3	08.7	1.2	151		
			SPR	168.5	e	3	17.4	0.8	50.8		
			SPZ	166.5	Pg	3	45.8	1.2	138		
			SPR	114*	Lg			1.4	381		
			SPT	110*	Lg			1.2	238		
			LPR	20.2	LQ			(13.0)	(52.1)		
			LPT	21.09	LQ			(13.0)	(10.9)		
			LPZ	25.6	LR			12.0	266		79.10
RG-SD	Redig, South Dakota	1383	SPZ	102.5	P	2	(58.4)	1.0	43.9	5.70	
			SPZ	102.5	e	3	01.6	0.8	72 7		
			SPZ	(76.9*)	PP	3	14.2	0.9	(259,		
			SPR	102.5	(Pg)	3	57.1	0.9	110		
			SPR	47.0	Lg			1.2	509		
			SPT	59.0	Lg			(1.2)	(601)		
			LPT	6.81	LQ			24.0	44.7		
			LPZ	9.13	LR			13.0	276		139.10
WN-SD	Winner, South Dakota	1511	SPZ	90.4	P	3	(15.0)	(1.2)	(437)	(6.40)	
			SPR	90.4	e	3	23.1	1.1	178		
			SPR	90.4	PP	3	26.8	(1.2)	(867)		
			SPR	90.4	Pg	4	11.9	(1.1)	(266)		
			SPR	90.4	e	5	11.2	1.1	169		
			SPR	84.6	Lg			1.4	481		
			SPT	53.2*	Lg			1.3	491		
			LPR	20.8	LQ			15.0	113		
			LPT	18.7	LQ			15.0	55.4		
			LPZ	32.8	LR			13.0	292		114.63
WMSO	Wichita Mountain Observatory, Oklahoma	1594	SPZ-8	163*	P	3	(28.1)	1.2	104	5.52	
			SPZ-4	183*	e	3	34.9	1.2	93.3		
			SPZ-8	163*	PP	3	(38.6)	1.1	72.1		
			SPZ-8	163*	e	3	46.2	1.1	48.1		
			SPZ-6	163*	Pg	4	30.9	1.1	221		
			SPN	50.0	Lg			1.8	423		
			SPE	50.0	Lg			1.45	161		
			LPR	9.0	LQ			15.0	43.6		
			LPZ	10.5	LR			16.0	93.2		75.71
CR-NB	Crete, Nebraska	1709	SPR	33.1	P	3	39.1	1.1	204	5.46	
			SPZ	33.1	e	3	44.8	1.0	242		
			SPZ	33.1	e	3	52.3	0.9	127		
			SPR	33.1	(Pg)	5	00.6	0.7	104		
			SPZ	33.1	(PcP)	8	43.0	0.8	108		
			SPR	15.5	Lg			1.2	488		
			SPT	15.6	Lg			1.2	683		
			LPR	9.21	LQ			15.0	125		
			LPT	9.94	LQ			15.0	78.9		
			LPZ	3.72	LR			12.0	559		112.24

Principal Phases - TAN

Table 2 - Page 1

Principal Phases
TAN
3 June 1966
14:00:00.0Z

[illegible]	Station	[illegible]	[illegible]	[illegible]	Phase	[illegible]		Period	[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]				
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[illegible]	Red Lake, Ontario, Canada	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Cumberland Plateau Observatory, Tennessee	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Alexander City, Alabama	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	Houlton, Maine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Schefferville, Quebec, Canada	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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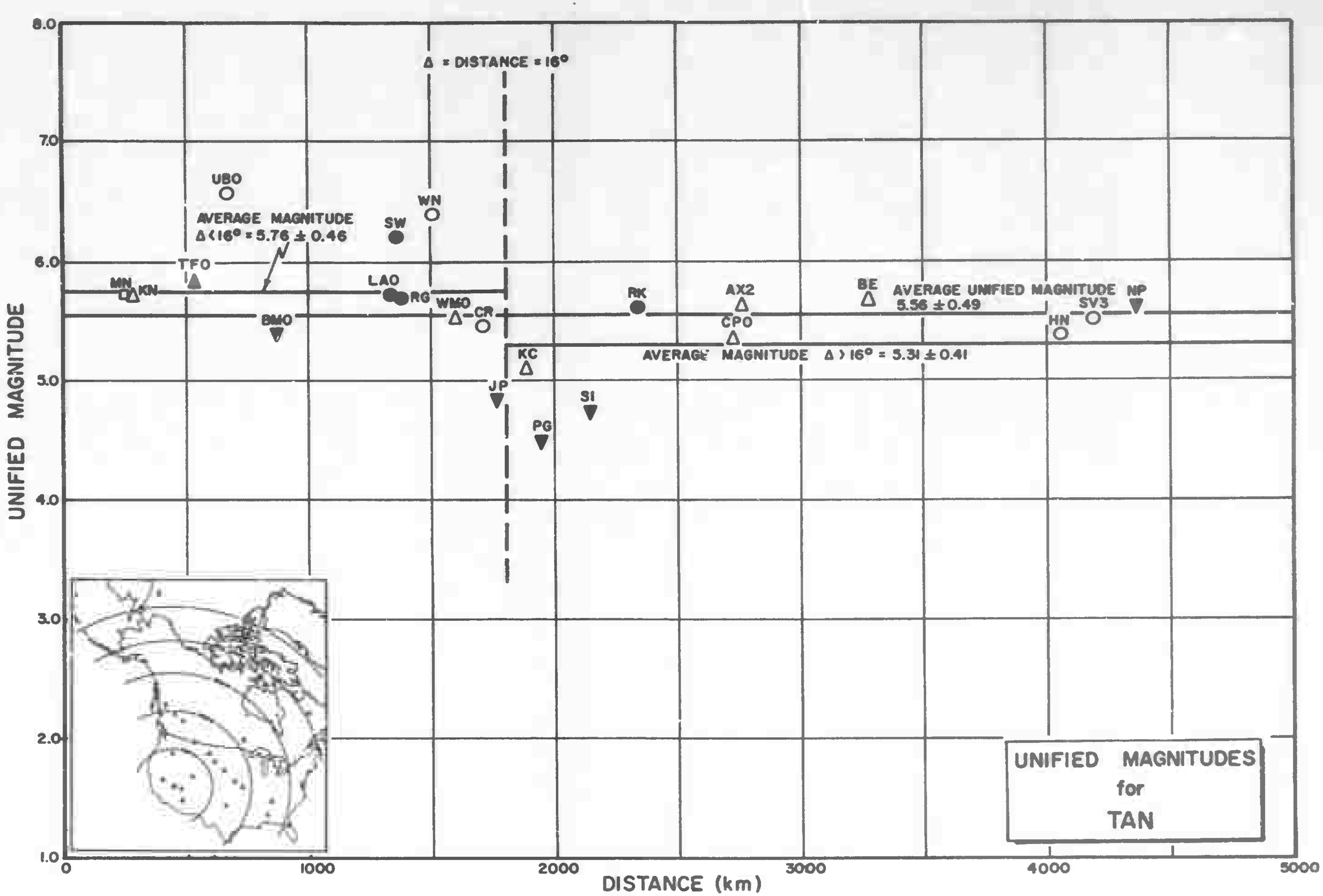
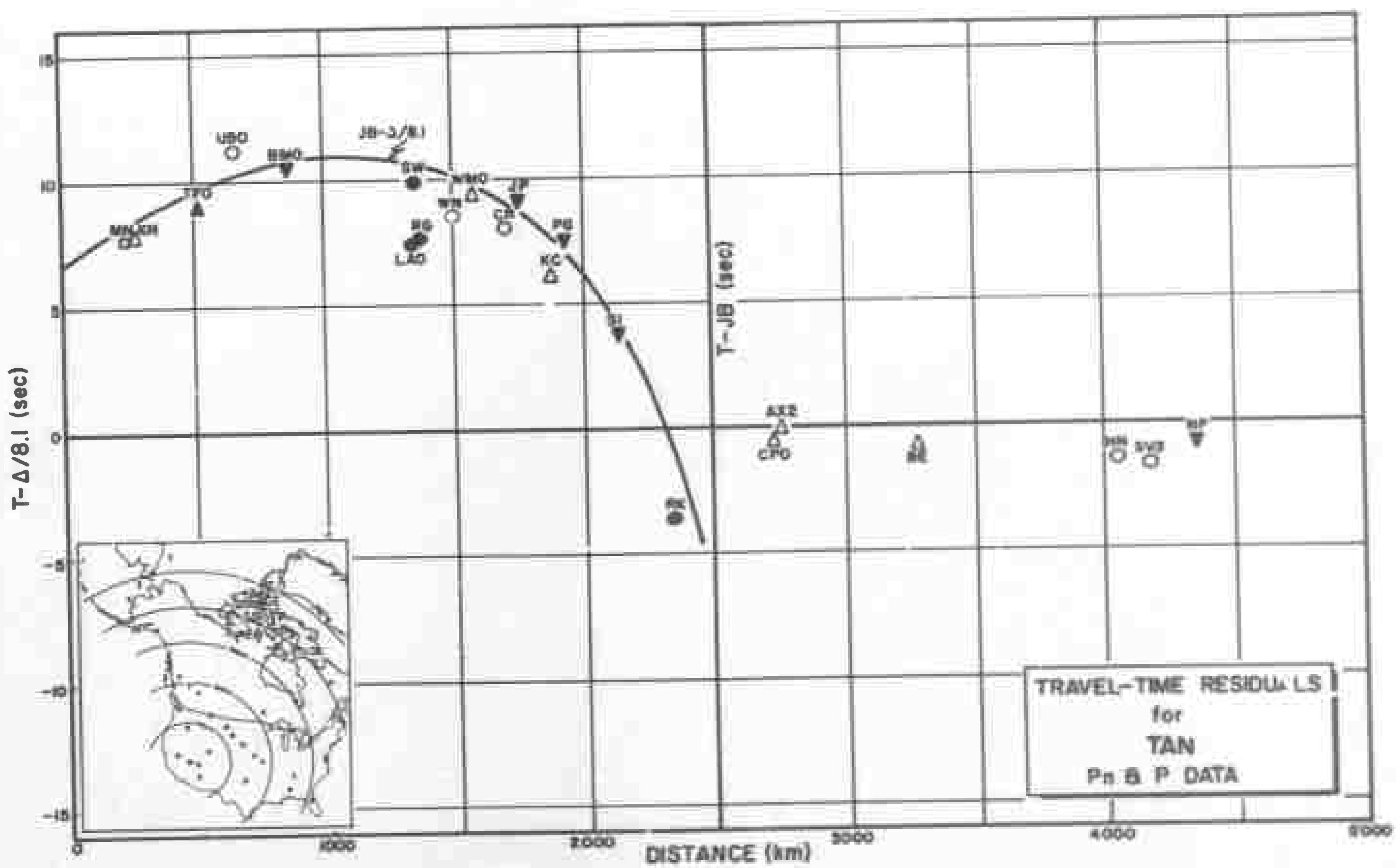
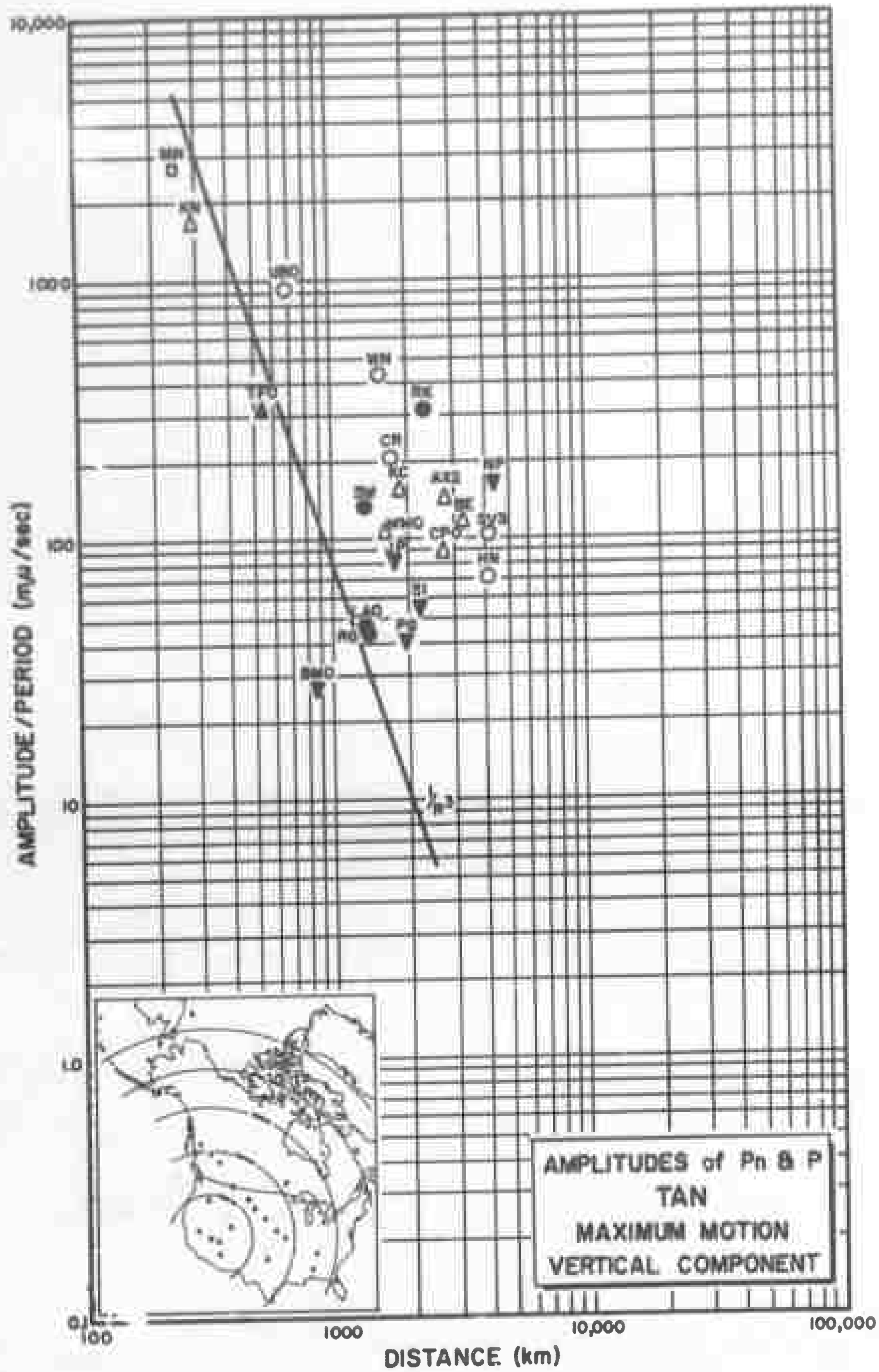

UNIFIED MAGNITUDES
for
TAN
UNIFIED MAGNITUDE
DISTANCE (km)
Δ = DISTANCE = 16°
AVERAGE MAGNITUDE
Δ<16° = 5.76 ± 0.46
AVERAGE UNIFIED MAGNITUDE
5.56 ± 0.49
AVERAGE MAGNITUDE Δ > 16° = 5.31 ± 0.41
UBO
WN
SW
TFO
MN
KN
LAO
RG
WMO
CR
BMO
RK
AX2
CPO
BE
NP
SV3
HN
KC
JP
SI
PG
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
1000
2000
3000
4000
5000

Figure 2



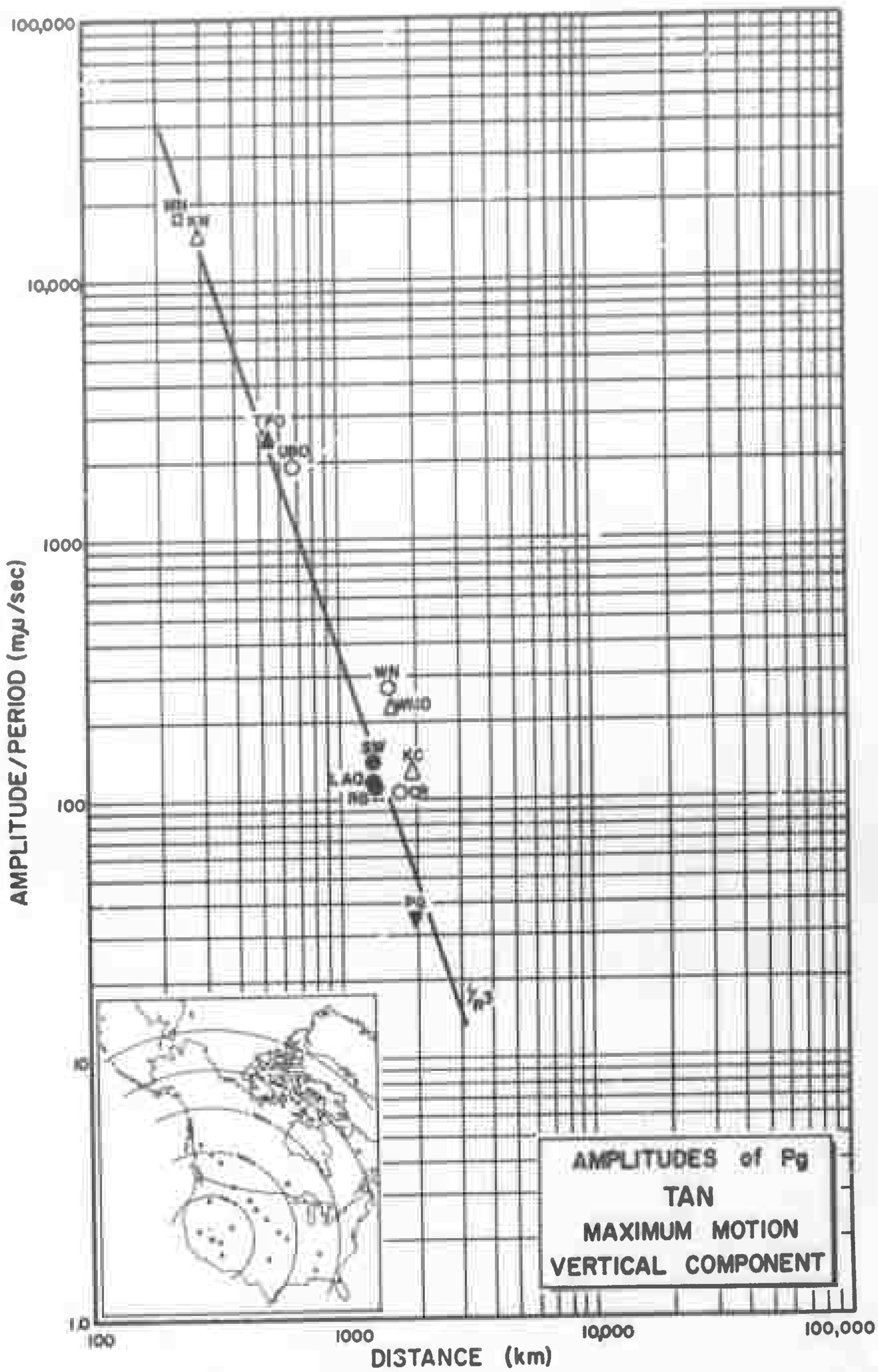
TRAVEL-TIME RESIDUALS
for
TAN
Pn & P DATA
T-Δ/8.1 (sec)
DISTANCE (km)
T-JB (sec)
JB-Δ/8.1
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000

Figure 3



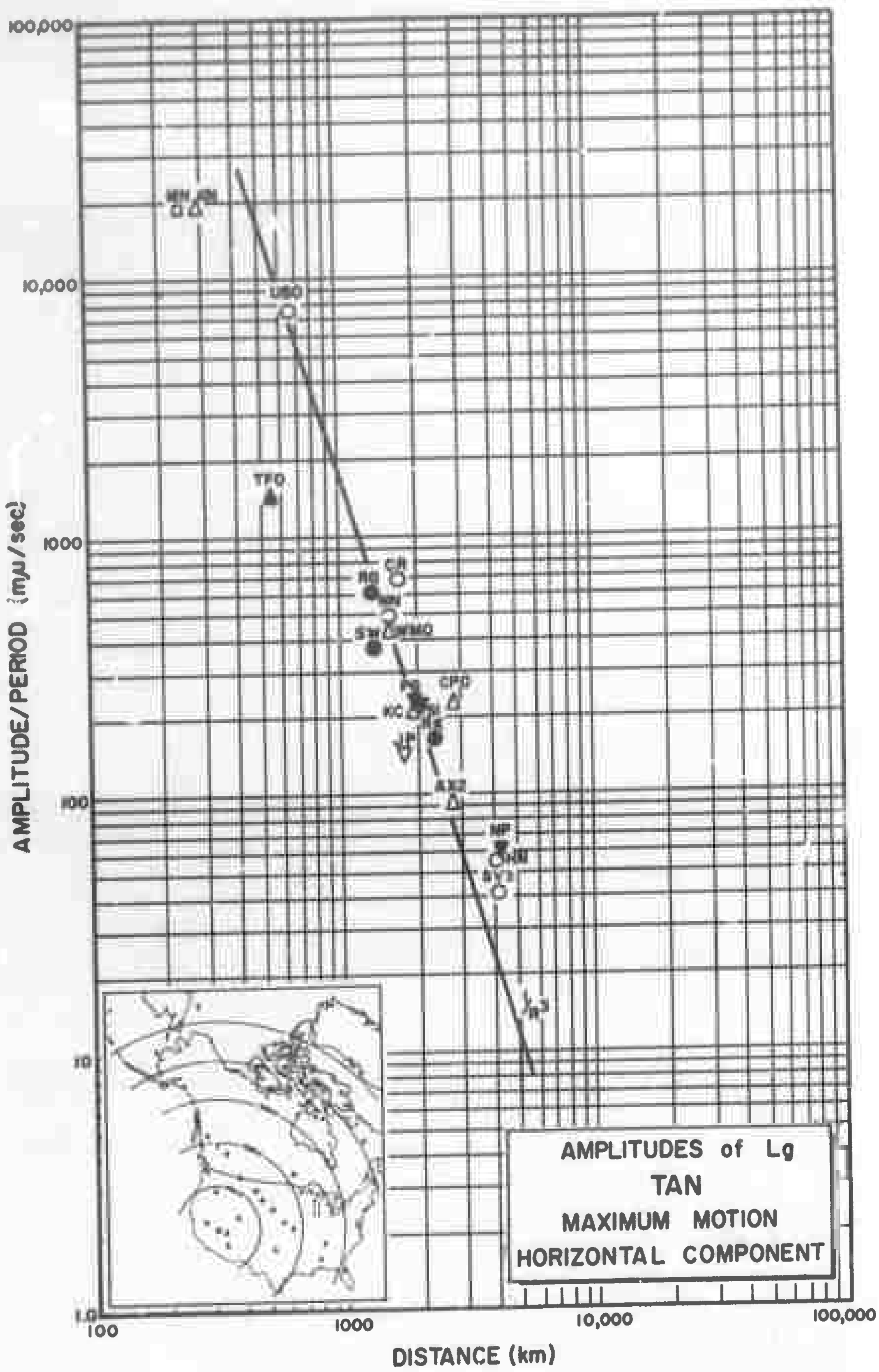
AMPLITUDES of Pn & P
TAN
MAXIMUM MOTION
VERTICAL COMPONENT
AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
10,000
1000
100
10
1.0
0.1
100
1000
10,000
100,000

Figure 4



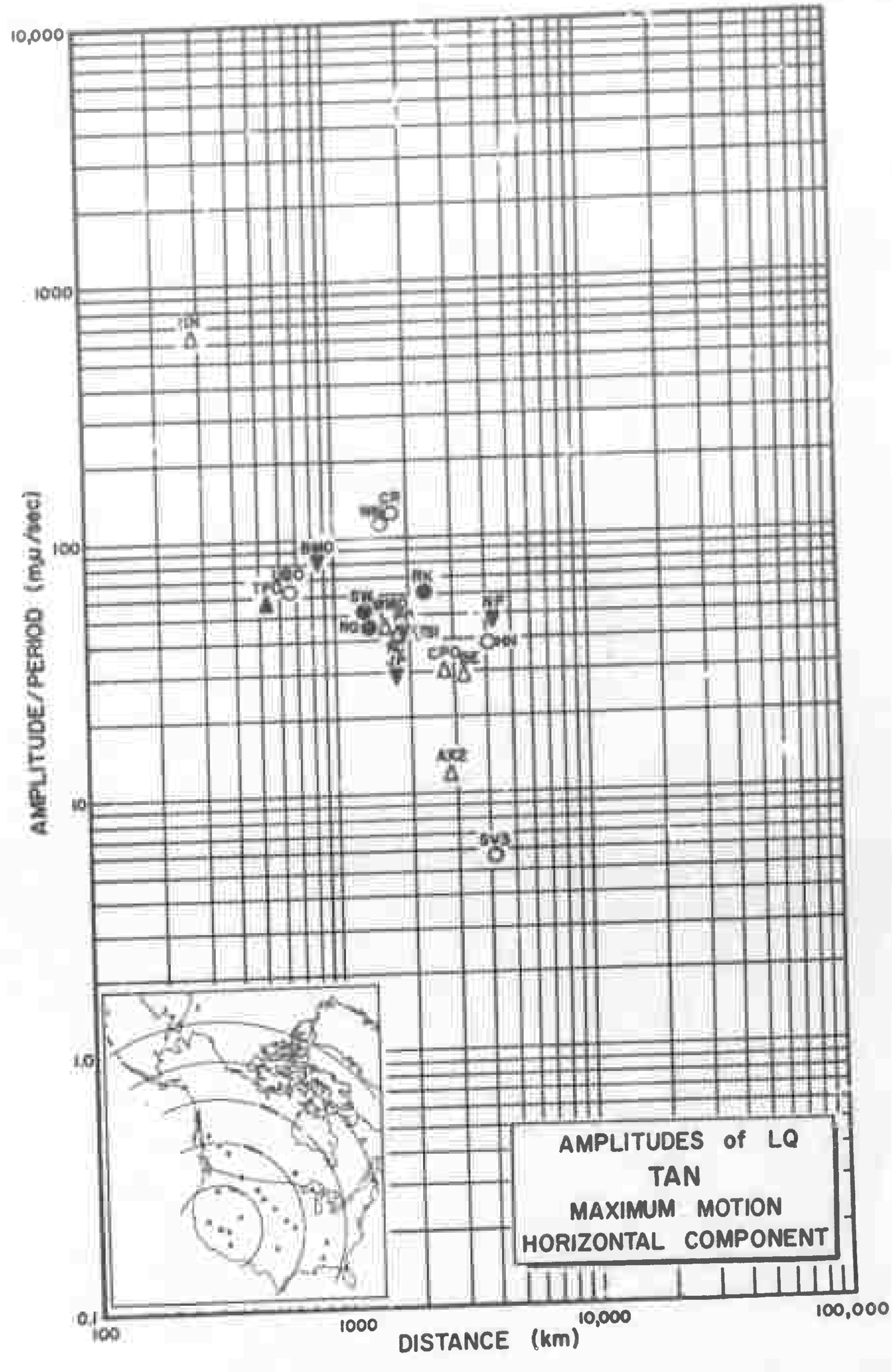
100,000
10,000
1000
100
10
1.0
AMPLITUDE/PERIOD (mμ/sec)
100
1000
10,000
100,000
DISTANCE (km)
WN
PO
UBO
SW
KC
PG
AMPLITUDES of Pg
TAN
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 5



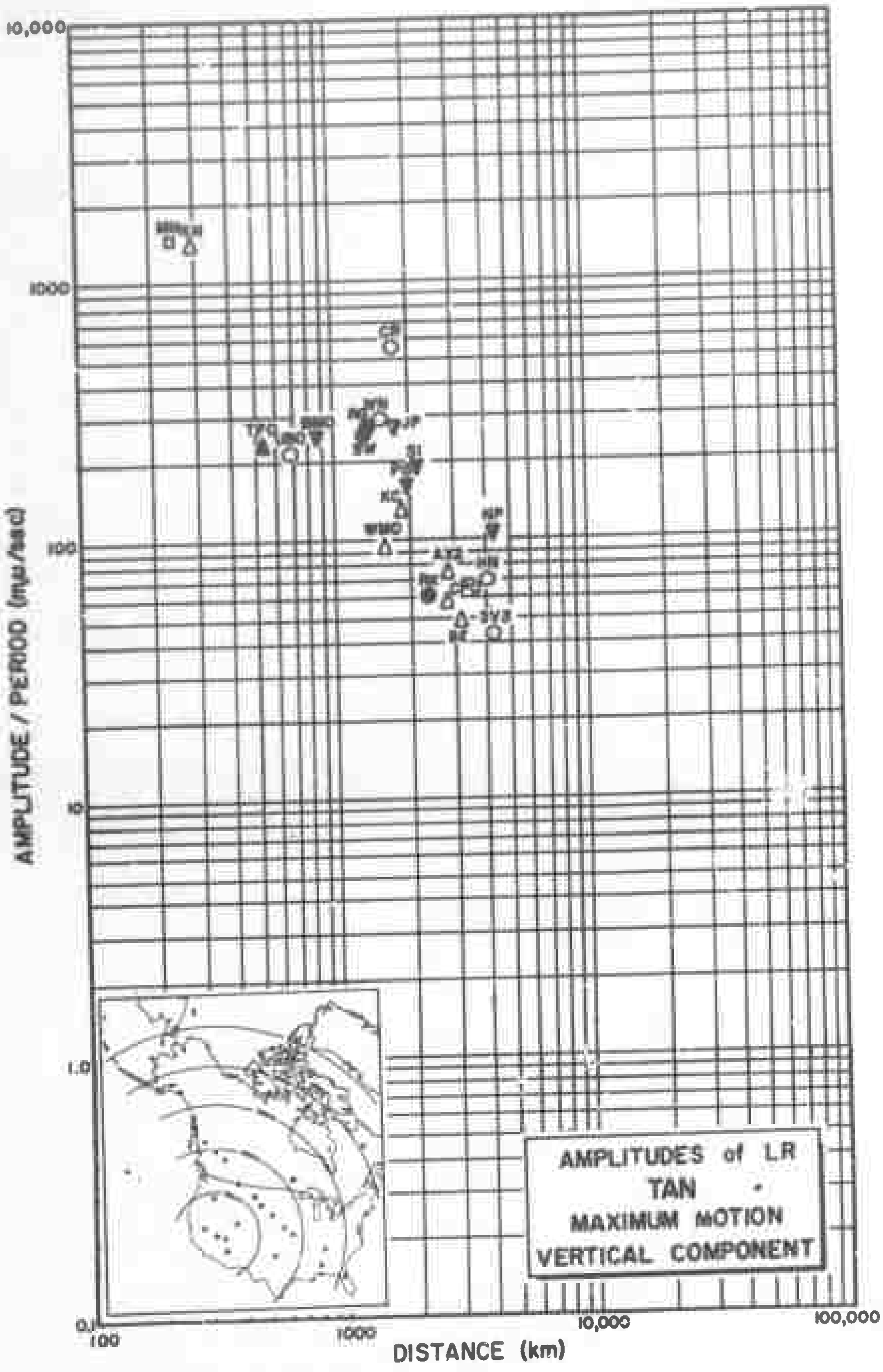
AMPLITUDES of Lg
TAN
MAXIMUM MOTION
HORIZONTAL COMPONENT
AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
100,000
10,000
1000
100
10
1.0
100
1000
10,000
100,000
UBO
TFO
CR
RG
CPO
AX2

Figure 6



AMPLITUDES of LQ
TAN
MAXIMUM MOTION
HORIZONTAL COMPONENT
AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
10,000
1000
100
10
1.0
0.1
100
1000
10,000
100,000

Figure 7



AMPLITUDE / PERIOD (mμ/sec)
10,000
1000
100
10
1.0
0.1
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of LR
TAN
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 8

Code	Station	Distance (km)	Geographic Latitude	Geographic Longitude	Elev. (km)	Computed Azimuth		Installed Azimuth		Large or Small SP	LP Inst.
						Epi. Sta.	Sta. Epi.	Radial	Tang.		
MN-NV	Mina, Nevada	240	38°26'10" N	118°08'53" W	1.52	310°	129°	308°	32°	L	X
KN-UT	Kanab, Utah	285	37°01'27" N	112°49'39" W	1.74	90°	271°	95°	185°	L	X
TFSO-Z1*	Tonto Forest Observatory, Arizona	531	34°17'12" N	111°16'03" W	1.49	124°	307°	90°	0°	JM	X
UBSO-Z10*	Uinta Basin Observatory, Utah	668	40°19'18" N	109°34'07" W	1.60	55°	239°	90°	0°	JM	X
BMSO-Z3*	Blue Mountain Observatory, Oregon	871	44°50'56" N	117°18'20" W	1.19	353°	173°	0°	90°	JM	X
LAO	Subarray AO-10, Montana	1342	46°41'19" N	106°13'20" W	.90	34°	221°			MSZ	
SW-MA*	Sweetgrass, Montana	1363	48°50'08" N	111°57'46" W	1.11	13°	196°	121°	211°	S	X
RG-SD*	Redig, South Dakota	1383	45°12'59" N	103°32'05" W	.95	45°	233°	127°	217°	L	X
WN-SD*	Winnar, South Dakota	1511	43°15'08" N	100°11'46" W	.79	58°	248°	129°	219°	L	X
WMSO-Z6*	Wichita Mountain Observatory, Oklahoma	1594	34°43'05" W	98°35'21" W	.51	94°	284°	90°	0°	JM	X
CR-NB*	Crete, Nebraska	1709	40°39'52" N	96°51'15" W	.44	71°	263°	131°	221°	L	X
JP-AT*	Jasper, Alberta, Canada	1767	52°53'50" N	118°05'25" W	1.13	355°	174°	114°	204°	L	X
KC-MO*	Kansas City, Missouri	1884	39°21'21" W	94°40'17" W	.27	76°	269°	133°	223°	S	X
PG-BC*	Prince George, British Columbia, Canada	1948	53°59'50" N	122°31'23" W	.91	347°	163°	110°	200°	L	X
SI-BC*	Smithers, British Columbia, Canada	2143	54°47'18" N	127°04'17" W	.58	340°	152°	107°	197°	L	X
RK-ON	Red Lake, Ontario, Canada	2343	50°50'20" N	93°40'20" W	.37	42°	238°	58°	148°	S	X
CPSO-Z8*	Cumberland Plateau Observatory, Tennessee	2729	35°35'41" N	85°34'13" W	.57	04°	282°	90°	0°	JM	X
AX2AL*	Alexander City, Alabama	2762	32°46'38" N	86°07'48" W	.23	91°	288°	138°	228°	L	X
BT-FL*	Belleview, Florida	3282	28°54'19" W	82°03'52" W	.02	96°	295°	140°	230°	S	X
HN-ME	Houlton, Maine	4066	45°09'43" W	67°59'09" W	.21	60°	273°	93°	183°	S	X
SV3QB*	Schefferville, Quebec, Canada	4189	54°48'39" N	66°45'00" W	.58	46°	263°	139°	229°	S	X
WP-NT	Mould Bay, Northwest Territories, Canada	4471	76°15'08" N	119°22'18" W	.06	359°	176°	356°	86°	JMZ S	X

*Seismometers Not Orientated Toward Nevada Test Site

Recording Site Information - TAN

Appendix I(A)

Unified Magnitude: $m = \log_{10} (A/T), + B$

where

A = zero to peak ground motion in millimicrons

$= \frac{(mm)\ (1000)}{K}$

T = signal period in seconds

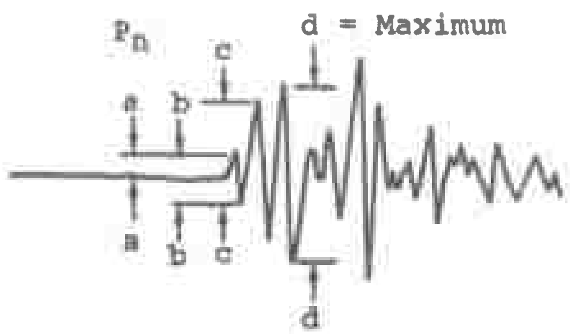
B = distance factor (see Table below)

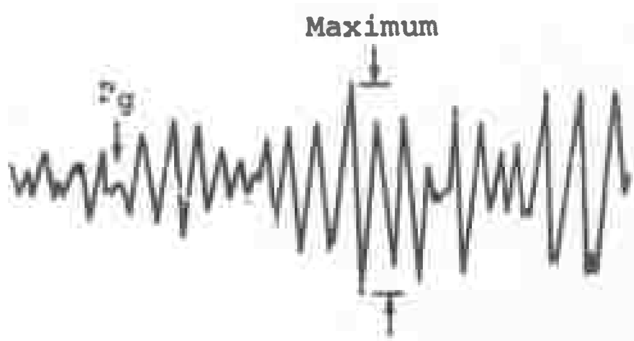
mm = record amplitude in millimeters zero to peak

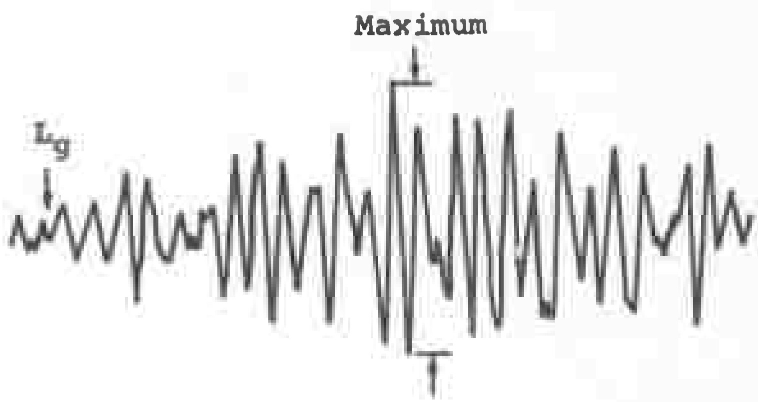
K = magnification in thousands at signal frequency

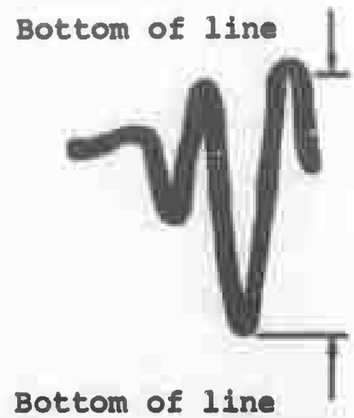
Table of Distance Factors (B) for Zero Depth

Dist (deg)	B	Dist (deg)	B	Dist (deg)	B	Dist (deg)	B
0°	-	27°	3.5	54°	3.8	80°	3.7
1	-	28	3.6	55	3.8	81	3.8
2	2.2	29	3.6	56	3.8	82	3.9
3	2.7	30	3.6	57	3.8	83	4.0
4	3.1	31	3.7	58	3.8	84	4.0
5	3.4	32	3.7	59	3.8	85	4.0
6	3.6	33	3.7	60	3.8	86	3.9
7	3.8	34	3.7	61	3.9	87	4.0
8	4.0	35	3.7	62	4.0	88	4.1
9	4.2	36	3.6	63	3.9	89	4.0
10	4.3	37	3.5	64	4.0	90	4.0
11	4.2	38	3.5	65	4.0	91	4.1
12	4.1	39	3.4	66	4.0	92	4.1
13	4.0	40	3.4	67	4.0	93	4.2
14	3.6	41	3.5	68	4.0	94	4.1
15	3.3	42	3.5	69	4.0	95	4.2
16	2.9	43	3.5	70	3.9	96	4.3
17	2.9	44	3.5	71	3.9	97	4.4
18	2.9	45	3.7	72	3.9	98	4.5
19	3.0	46	3.8	73	3.9	99	4.5
20	3.0	47	3.9	74	3.8	100	4.4
21	3.1	48	3.9	75	3.8	101	4.3
22	3.2	49	3.8	76	3.9	102	4.4
23	3.3	50	3.7	77	3.9	103	4.5
24	3.3	51	3.7	78	3.9	104	4.6
25	3.5	52	3.7	79	3.8	105	4.7
26	3.4	53	3.7				









Detail Showing Allowance For Line Width

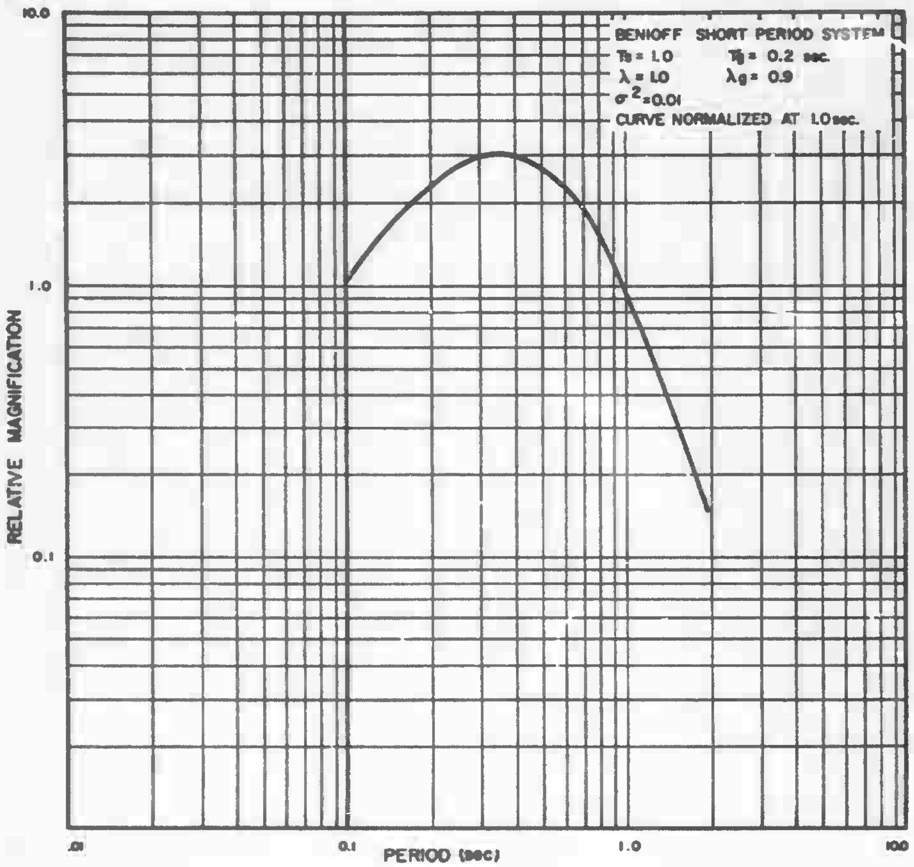
Pick <u>time</u> of <u>Pn</u> at beginning of "a" half cycle.

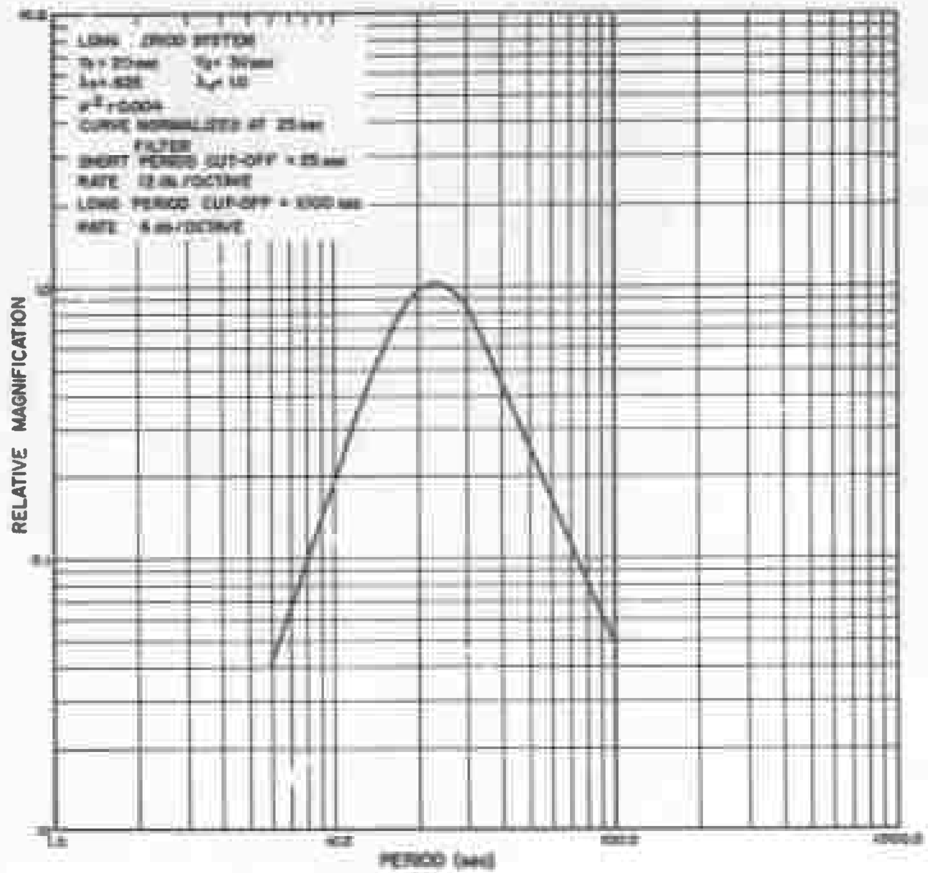
Pick <u>amplitude</u> of <u>Pn</u> as maximum "$d/2$" within 2 or 3 cycles of "c".

Pick <u>amplitudes</u> of <u>Pg</u> and <u>Lg</u> at maximum of corresponding motion.

Seismic Analysis Diagram

APPENDIX II(A)





INSTRUMENT RESPONSE CURVES - LRSM

Appendix II(B)

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) TELEDYNE INDUSTRIES, INC. EARTH SCIENCES DIVISION ALEXANDRIA, VIRGINIA 22314	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP ---
3. REPORT TITLE Long Range Seismic Measurements - TAN	
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Scientific	
5. AUTHOR(S) (Last name, first name, initial) Clark, Don M.	

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
31 October 1966	20	1

8a. CONTRACT OR GRANT NO. AF 33(657)-15919 b. PROJECT NO. VELA T/6702 c. ARPA Order No. 624 d. ARPA Program Code No. 5810	9a. ORIGINATOR'S REPORT NUMBER(S) SDL Report No. 169 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) ---

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
---	ADVANCED RESEARCH PROJECTS AGENCY NUCLEAR TEST DETECTION OFFICE WASHINGTON, D. C.

13. ABSTRACT

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

DD FORM 1 JAN 64 1473

Unclassified
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Seismic Magnitude						
Seismic Travel-Time						
Seismic Amplitude						
VELA-UNIFORM						
Nuclear Tests						

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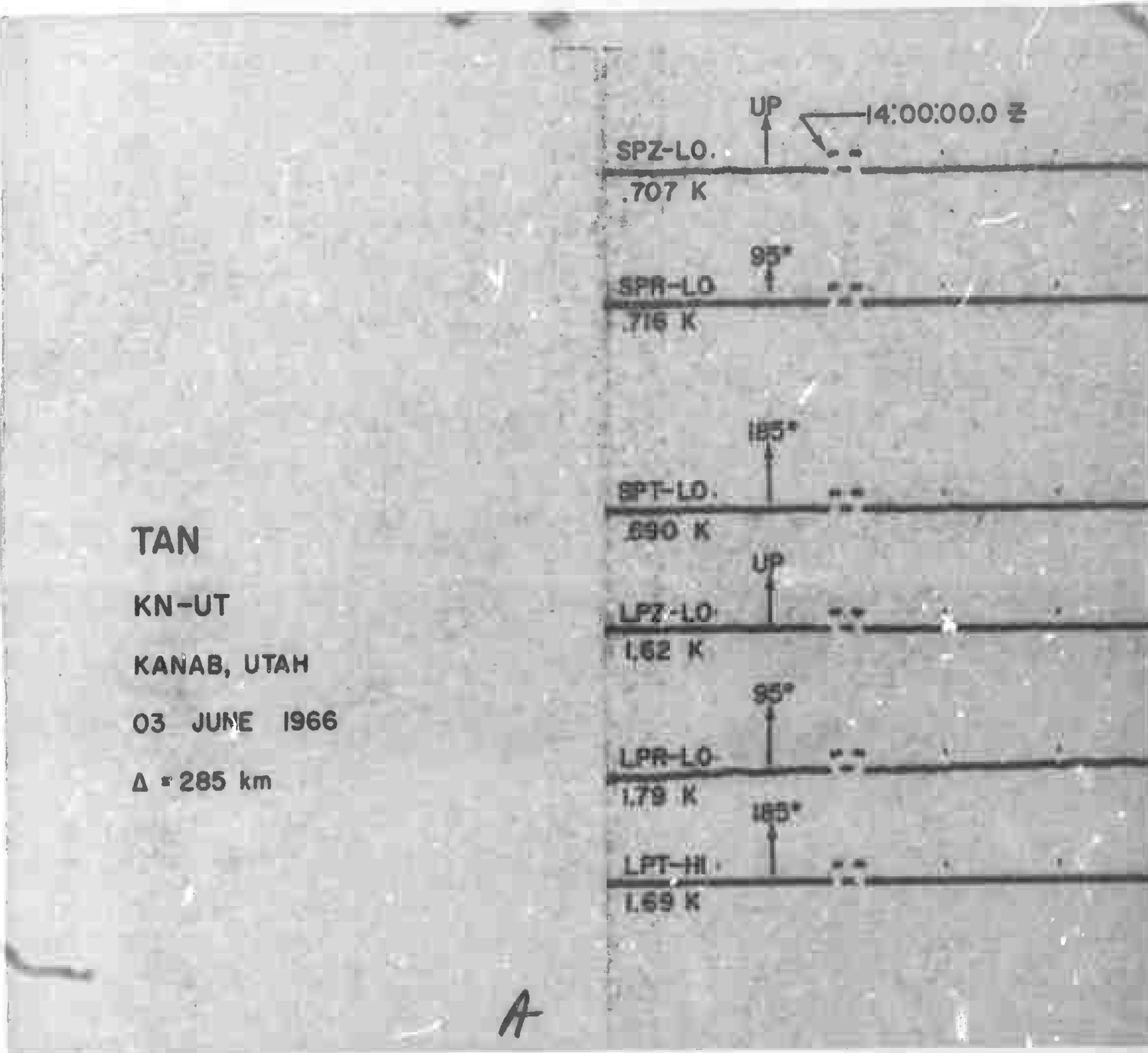
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KN-UT
KANAB, UTAH
03 JUNE 1966
Δ = 285 km
UP
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SPZ-LO.
.707 K
95°
SPR-LO
.716 K
185°
SPT-LO.
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UP
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LPR-LO
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185°
LPT-HI
1.69 K
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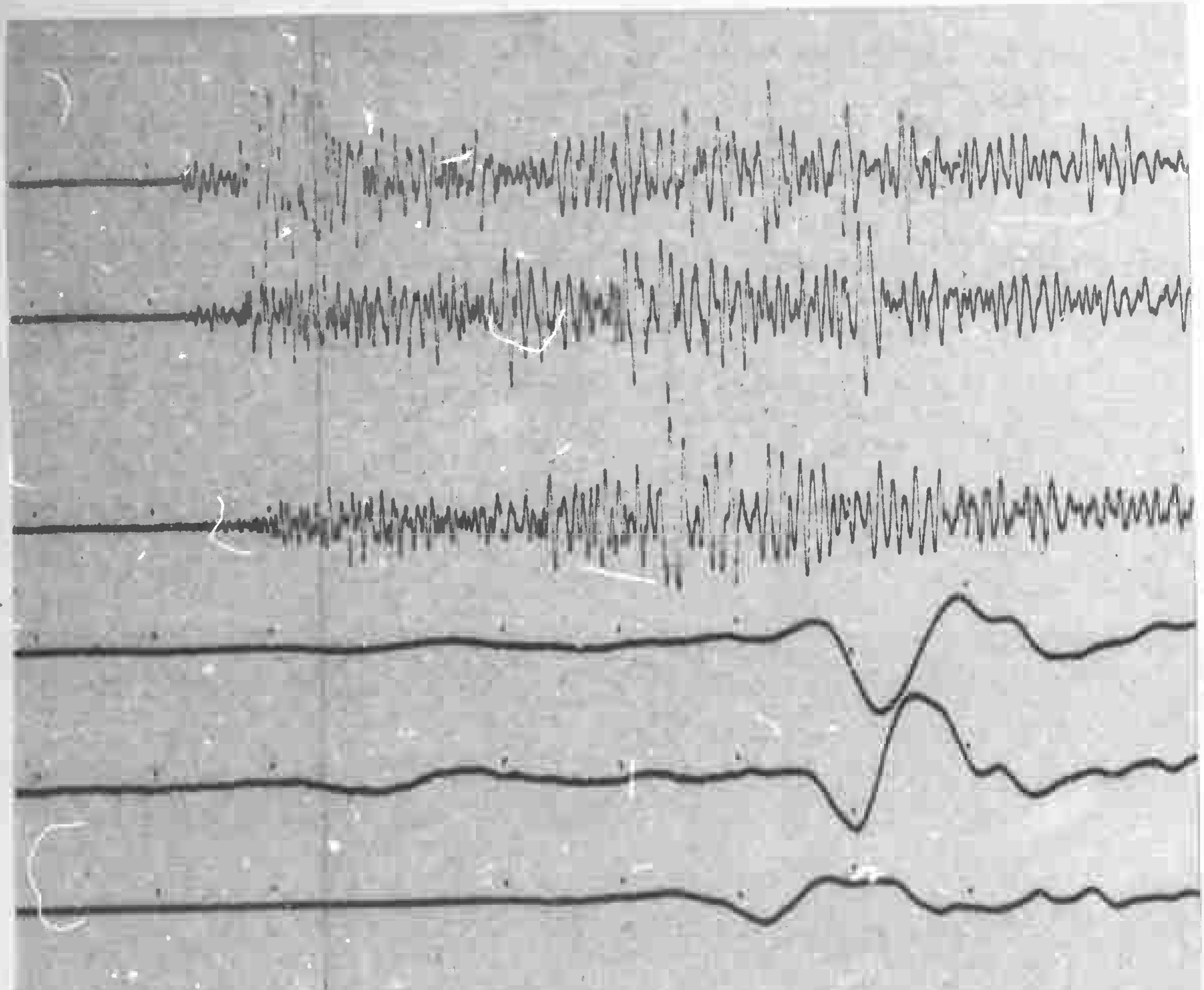

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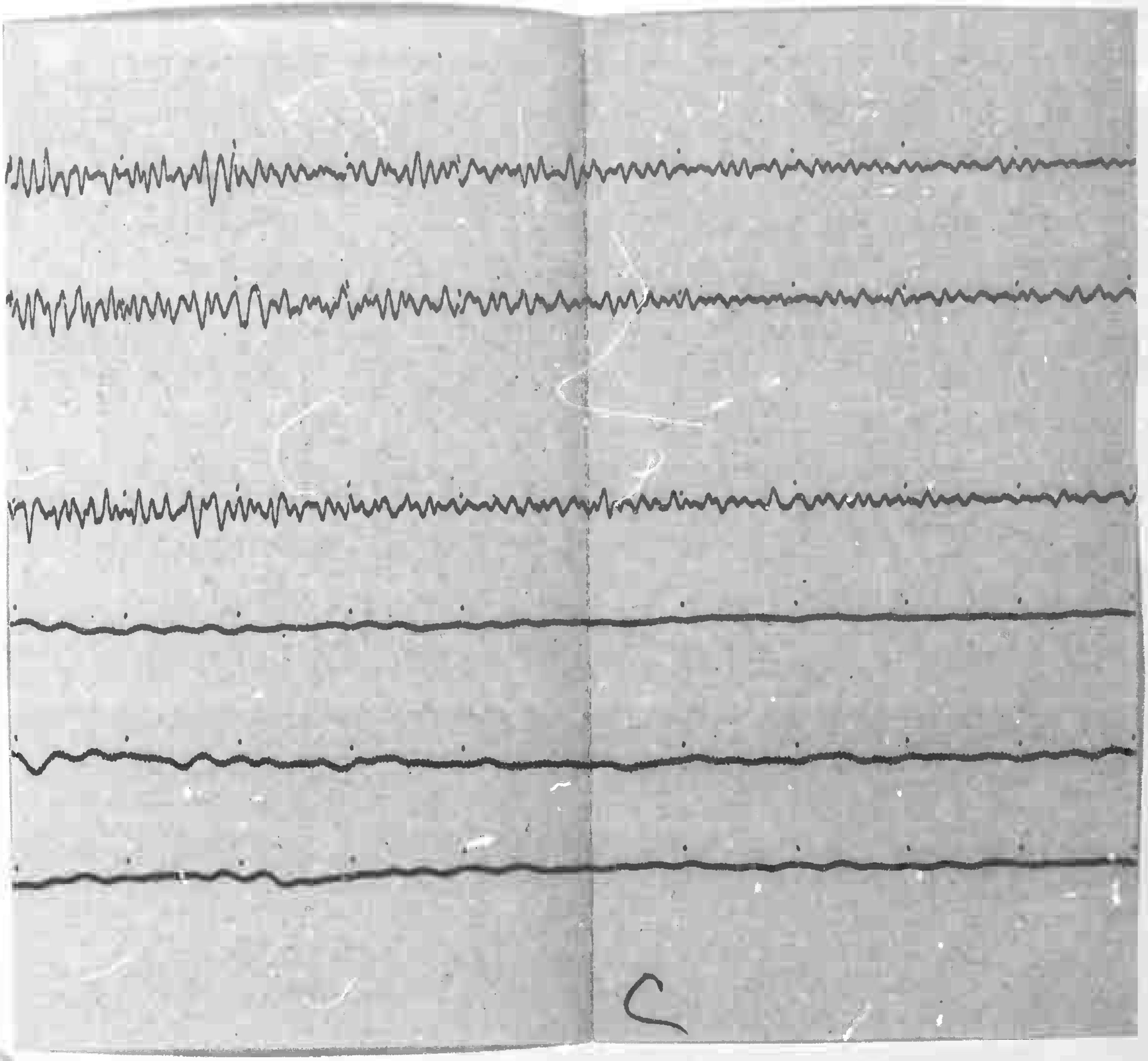
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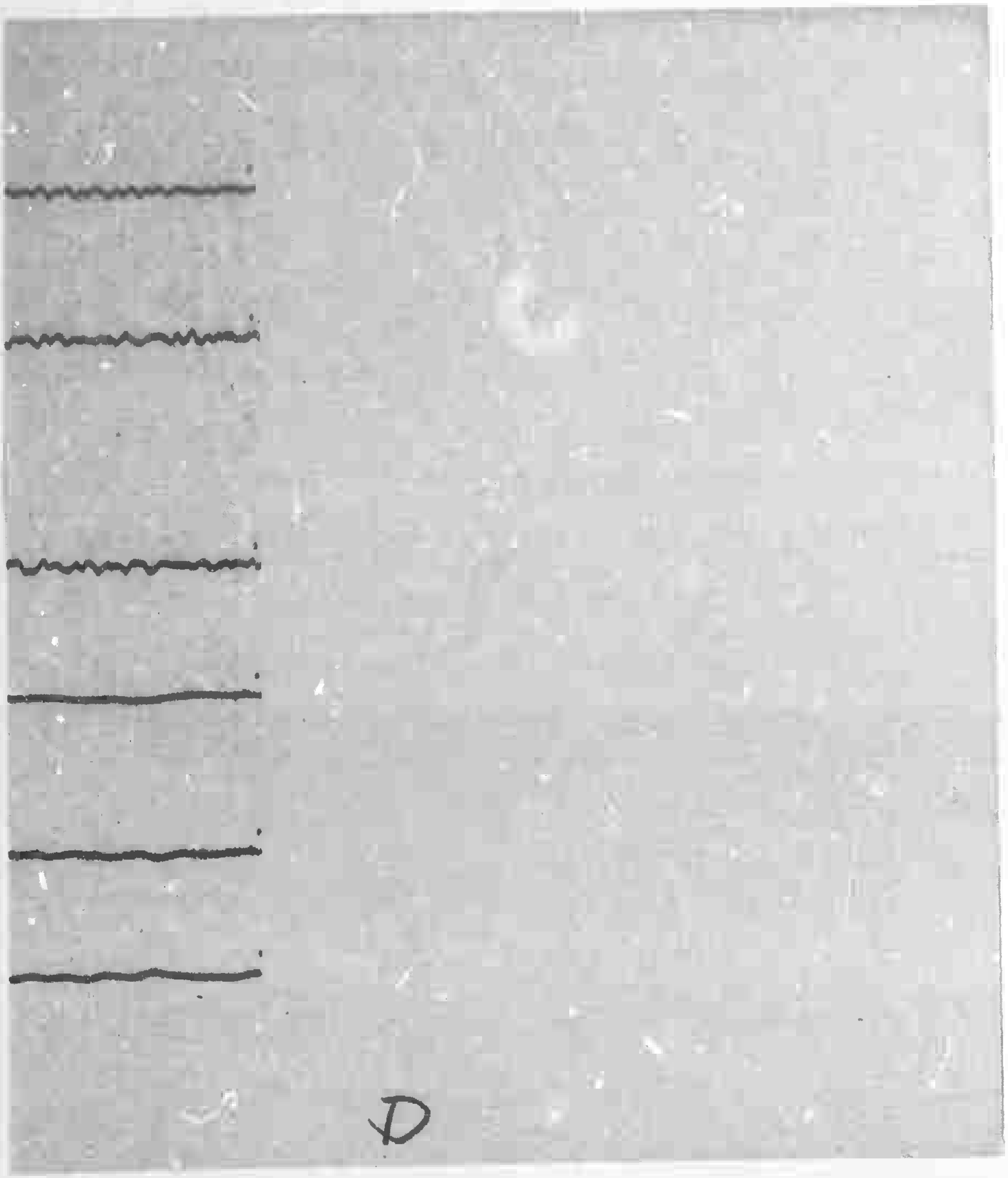
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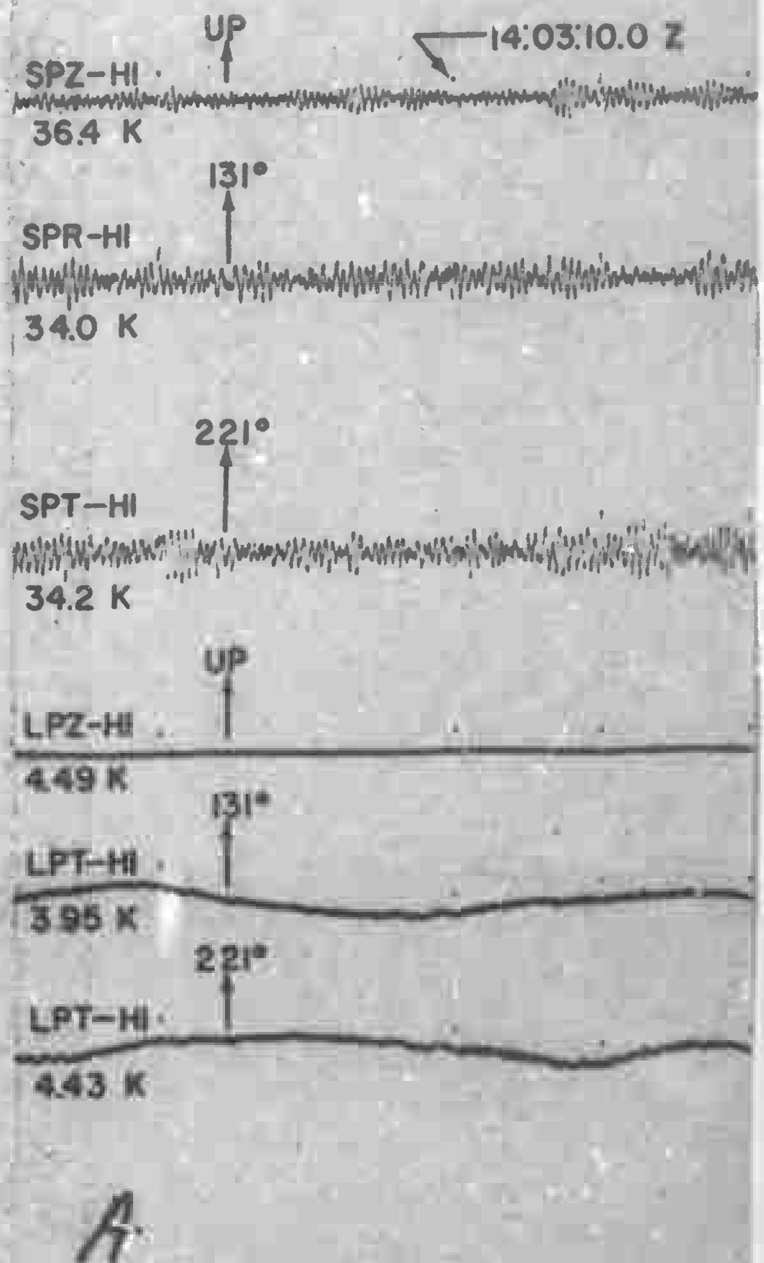
TAN

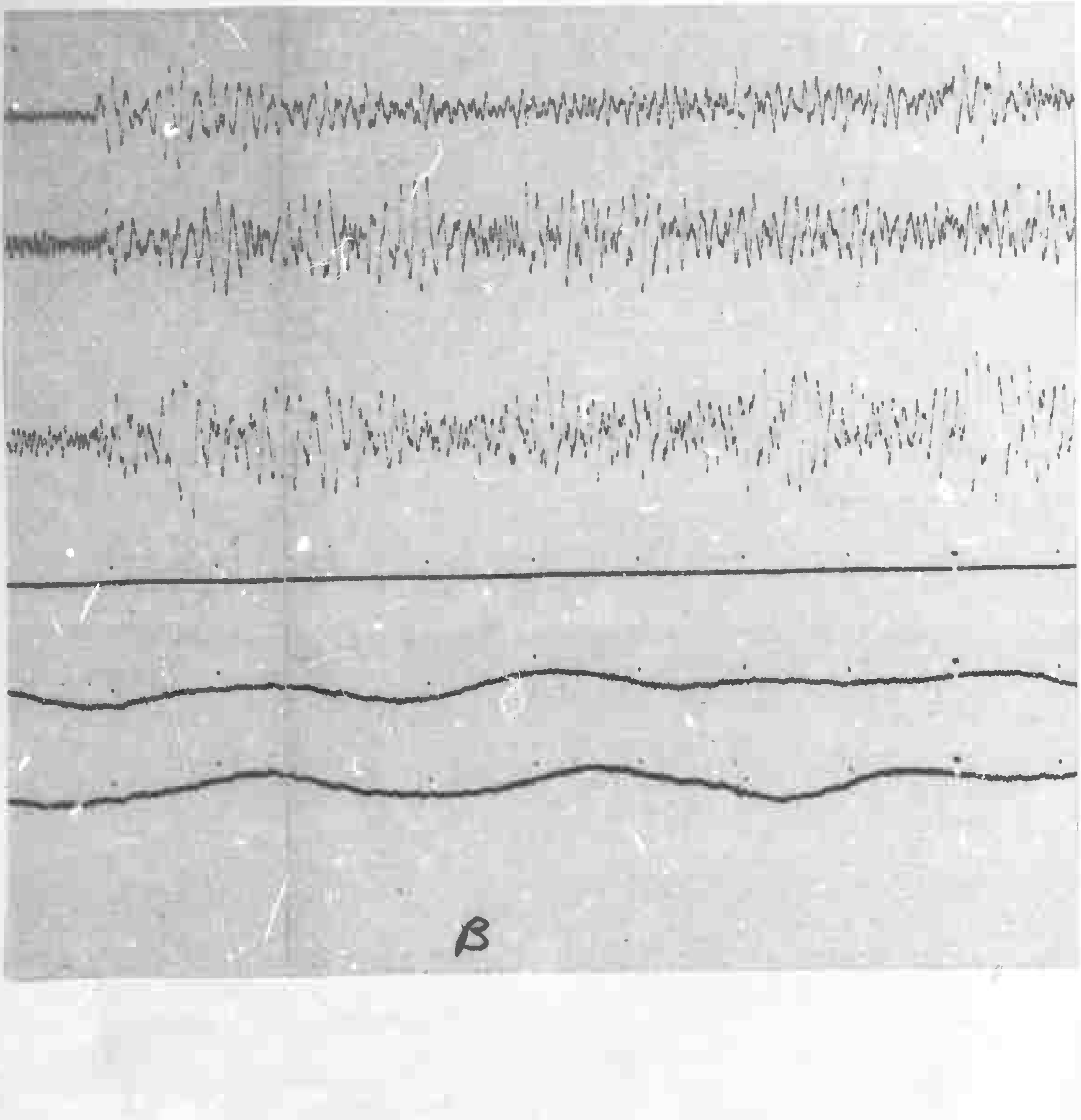
CR-NB

CRETE, NEBRASKA

03 JUNE 1966

Δ = 1709 km





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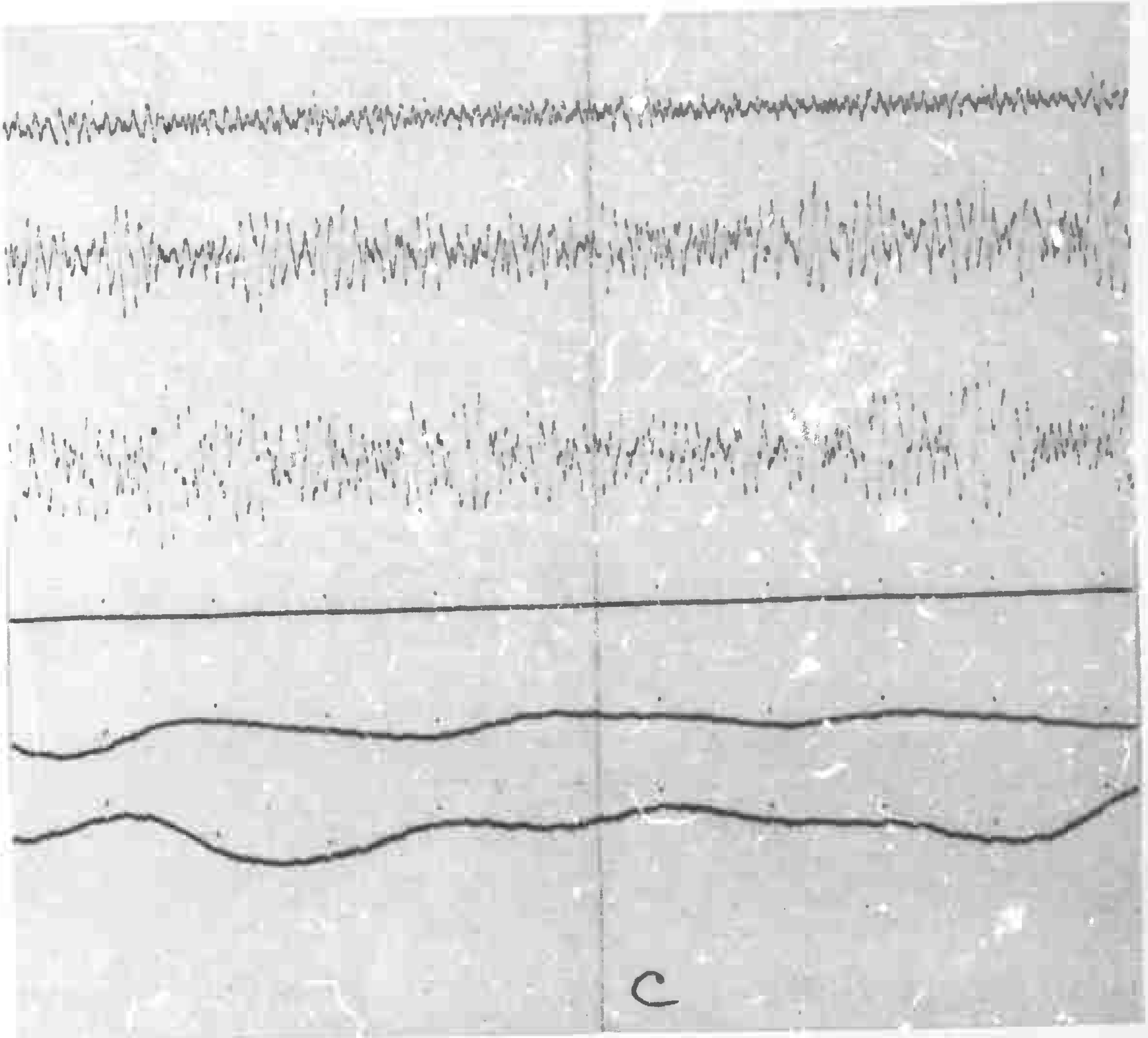
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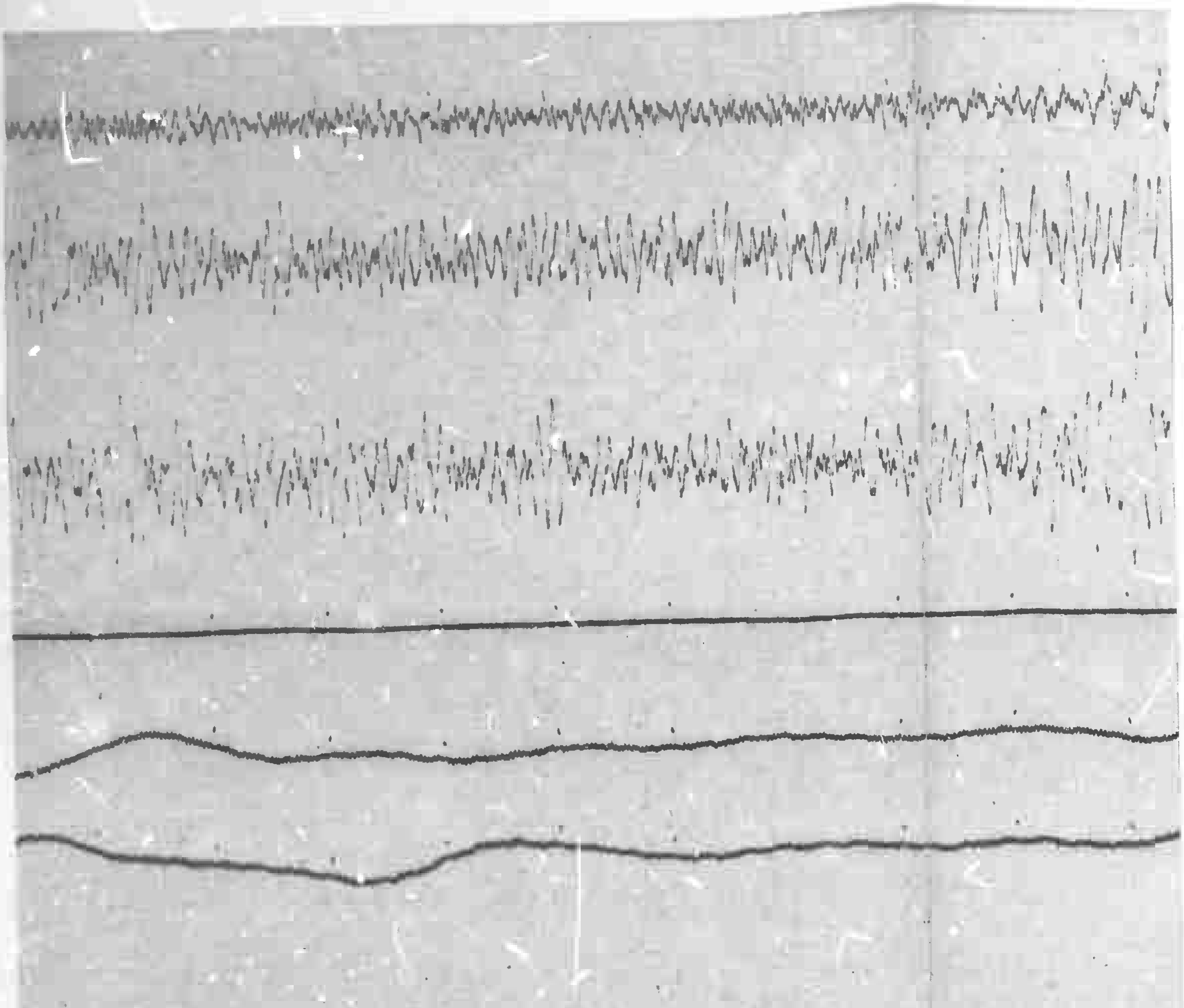

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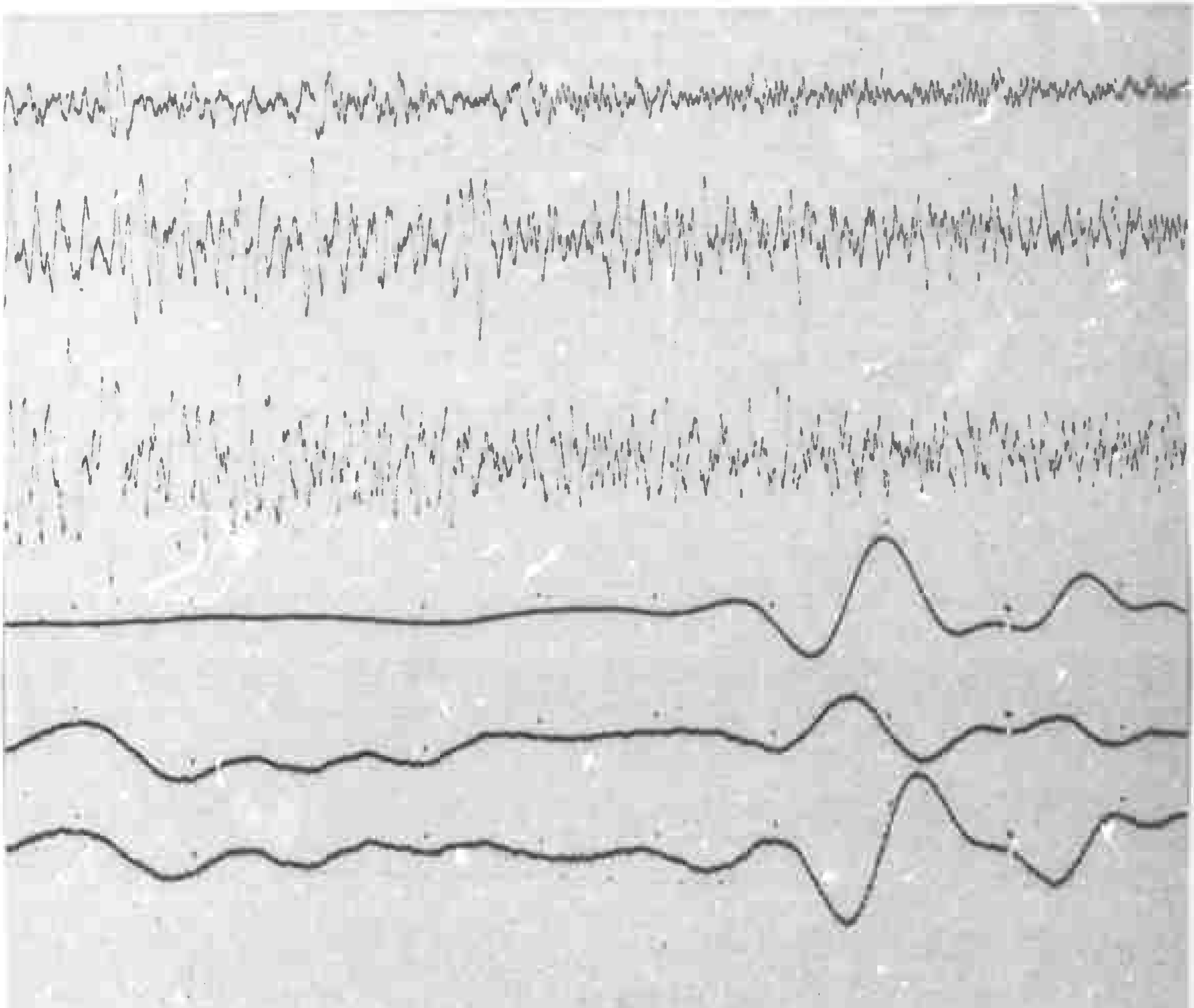

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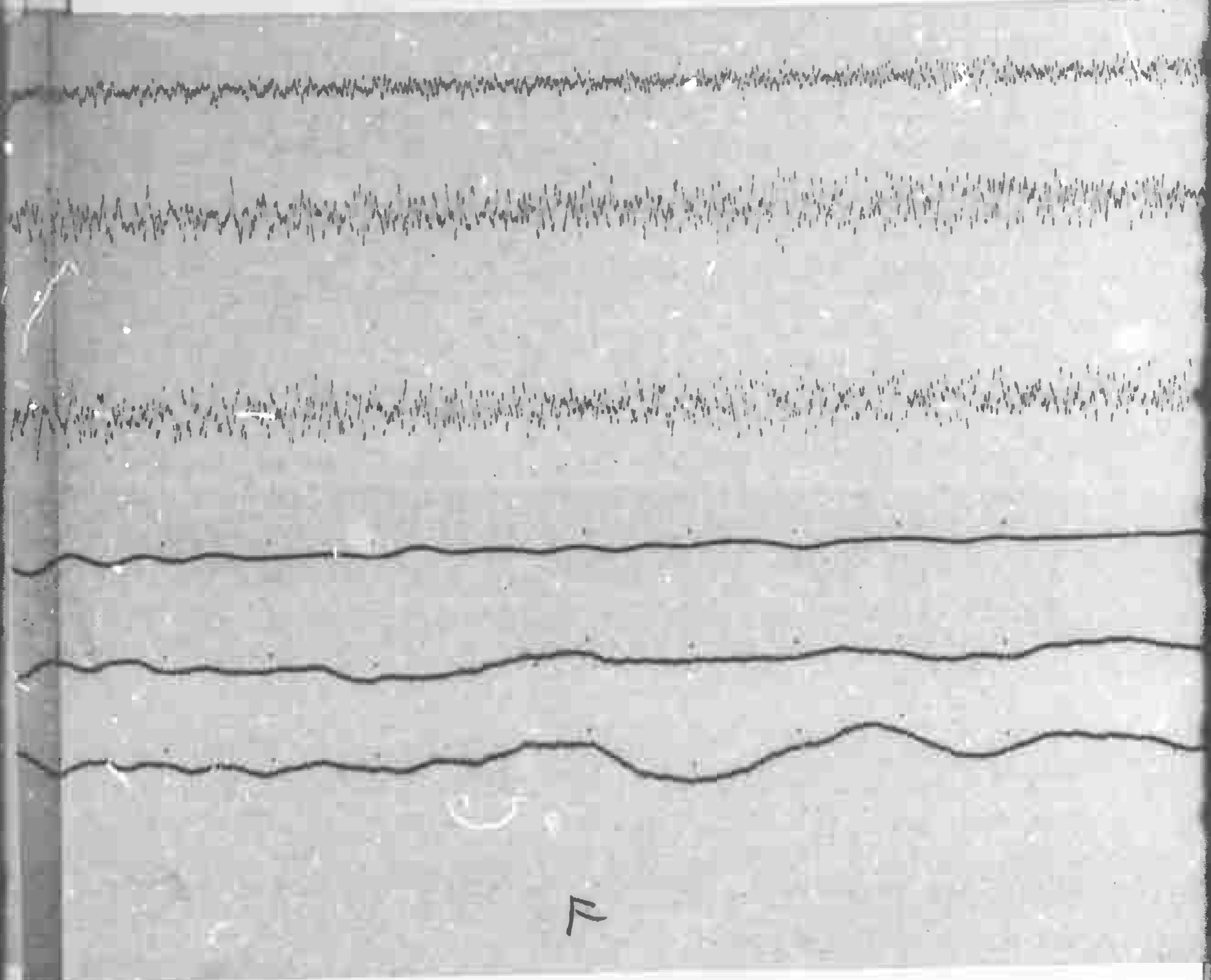
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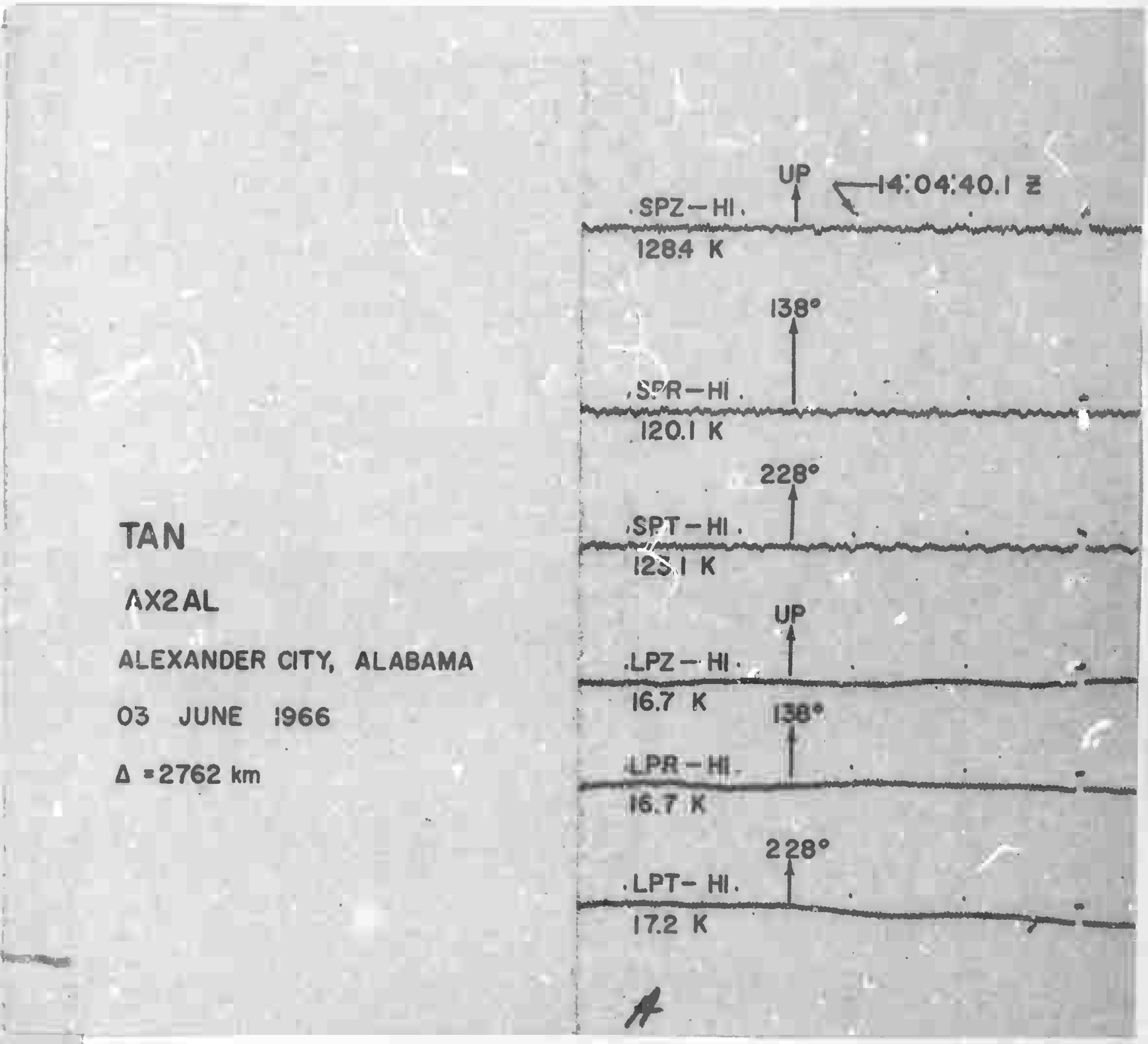

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ALEXANDER CITY, ALABAMA
03 JUNE 1966
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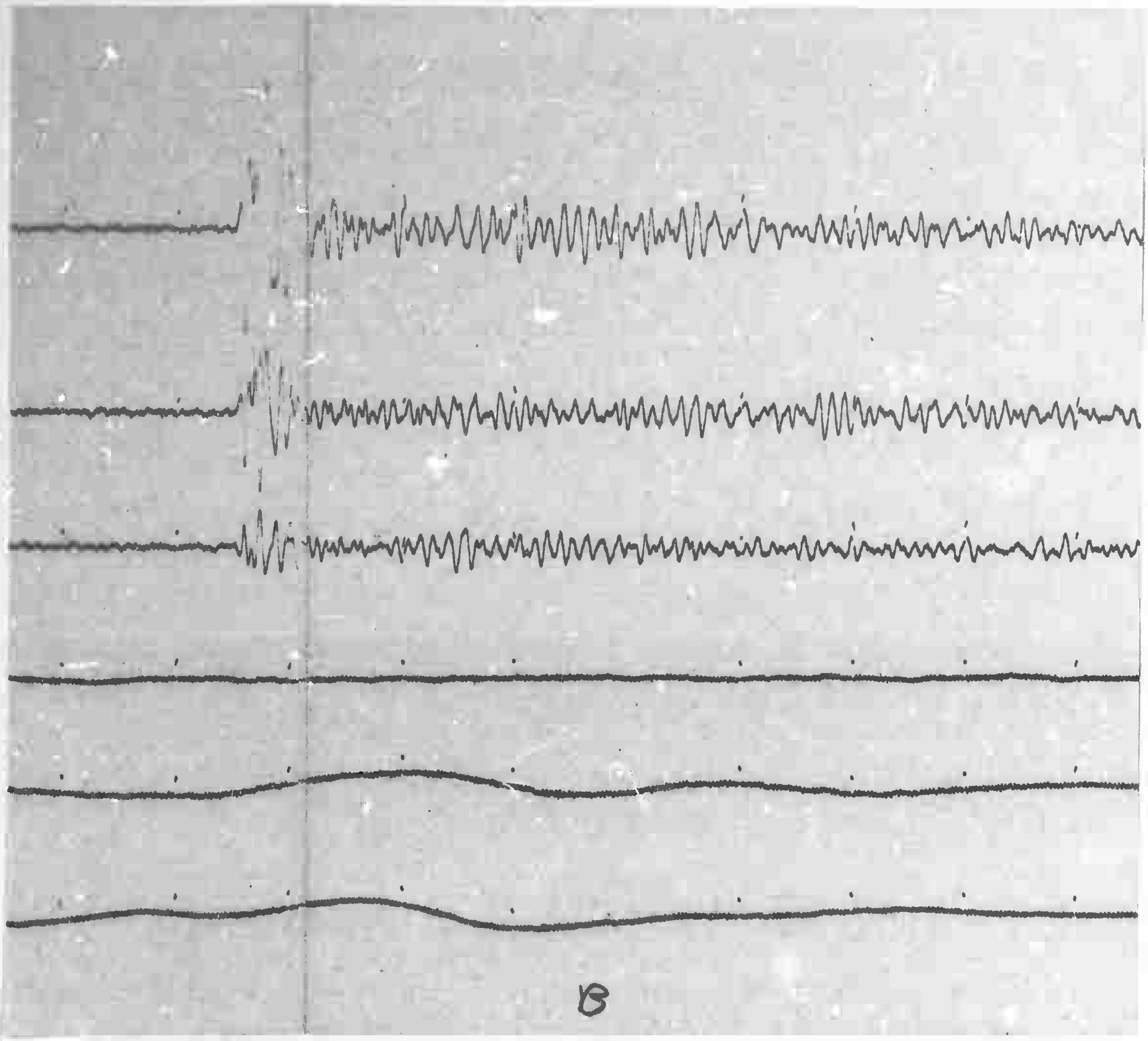
SPZ–HI
128.4 K
138°
SPR–HI
120.1 K
228°
SPT–HI
UP
LPZ–HI
16.7 K
138°
LPR–HI
16.7 K
228°
LPT–HI
17.2 K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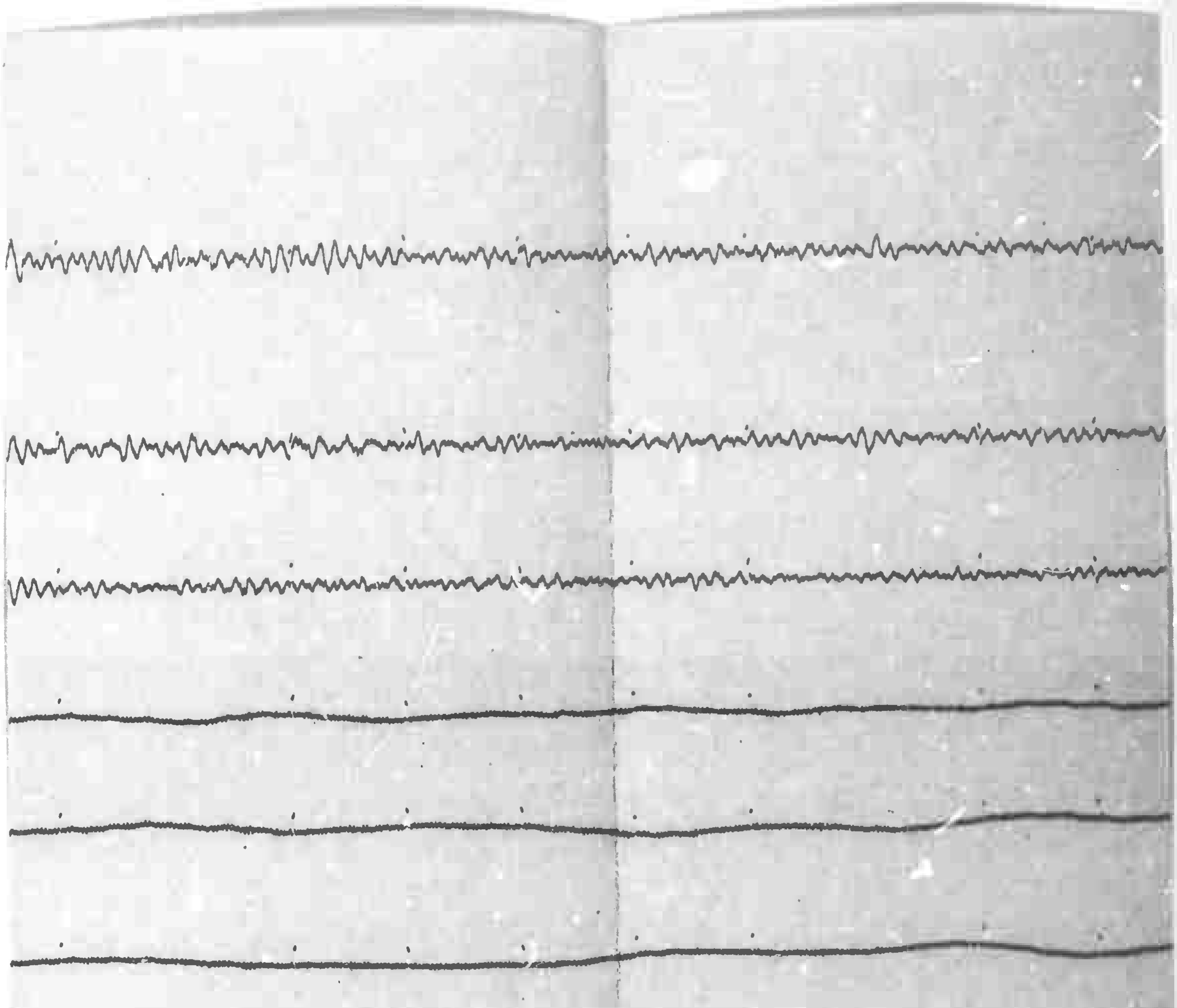

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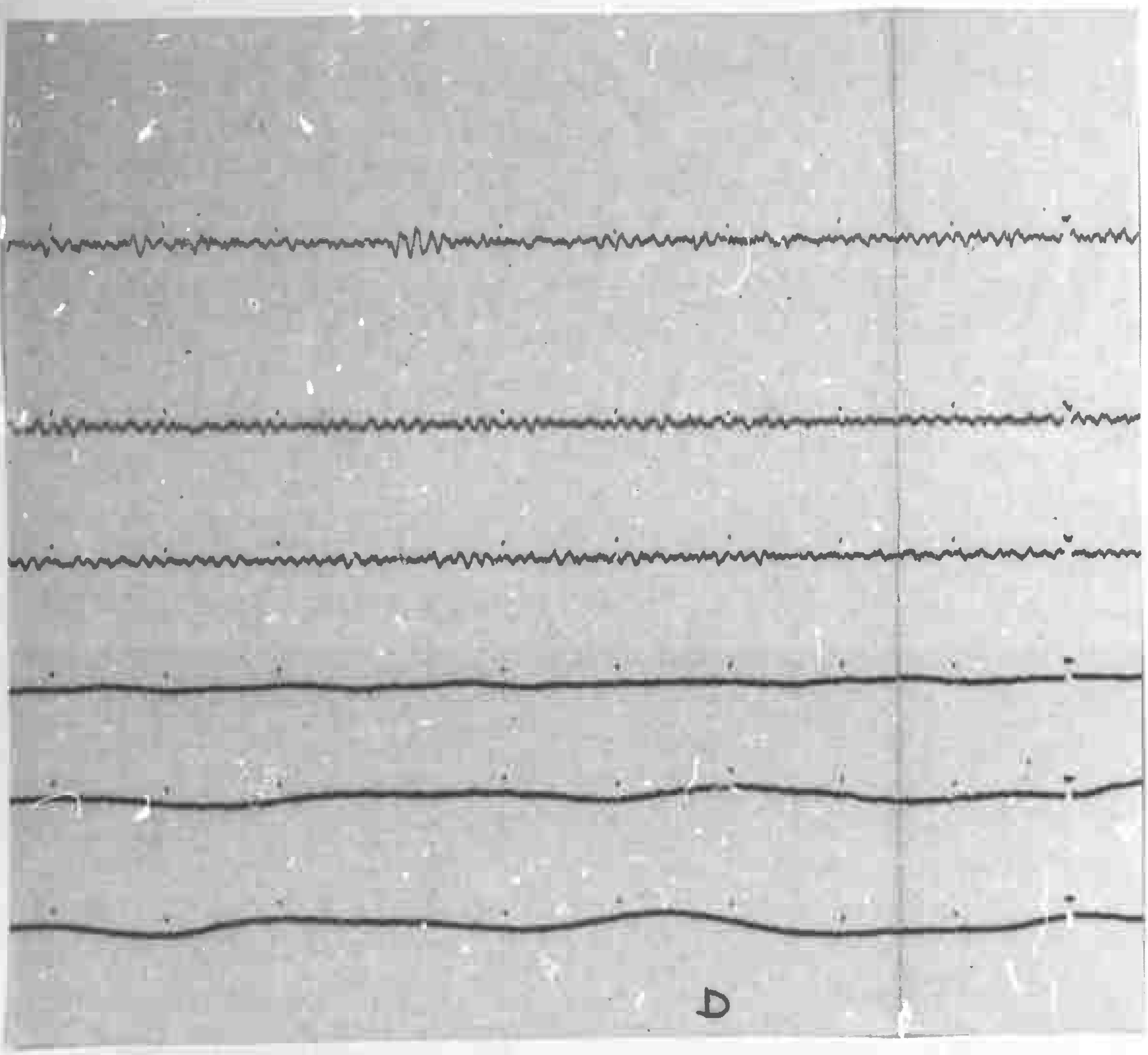
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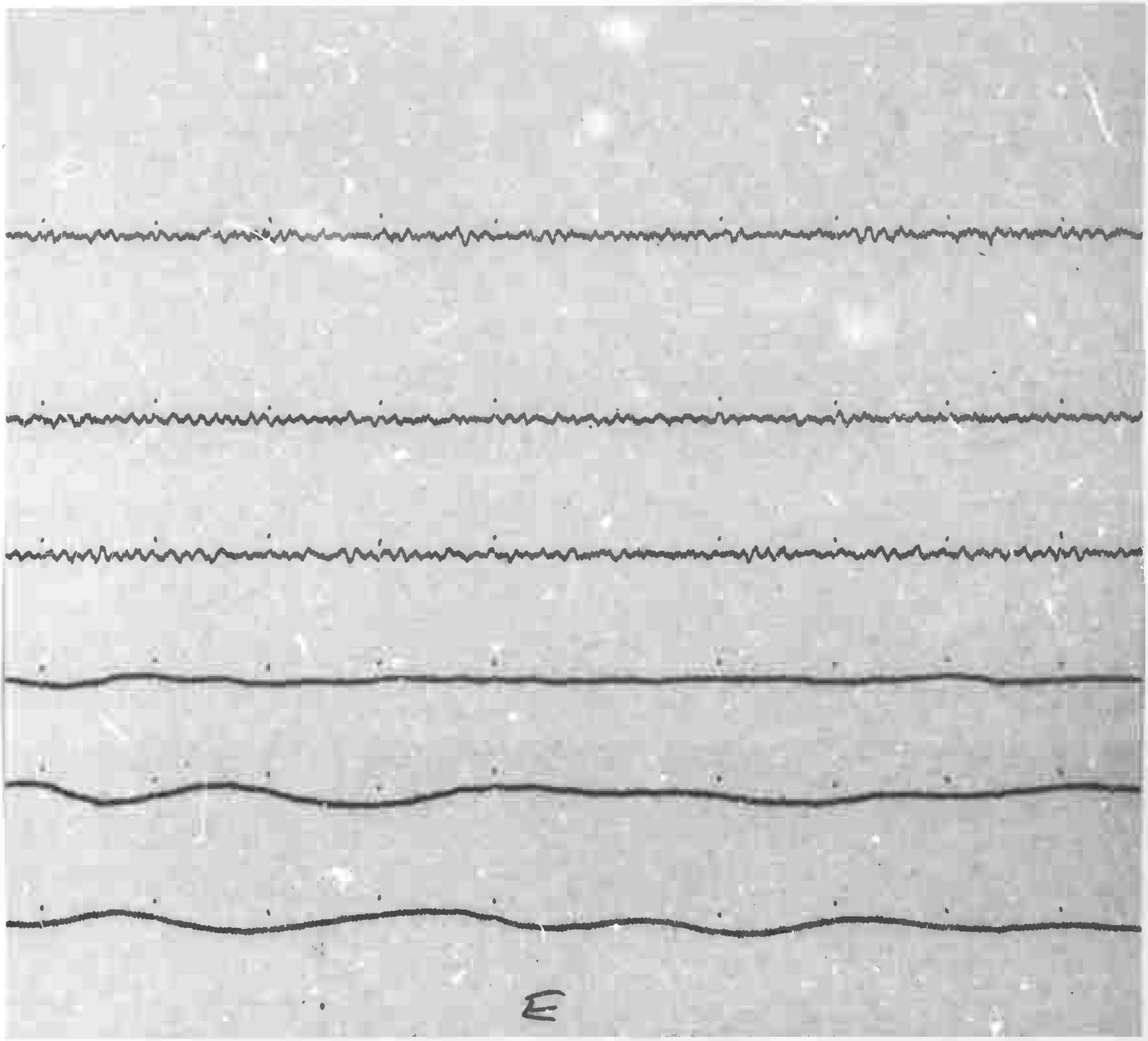
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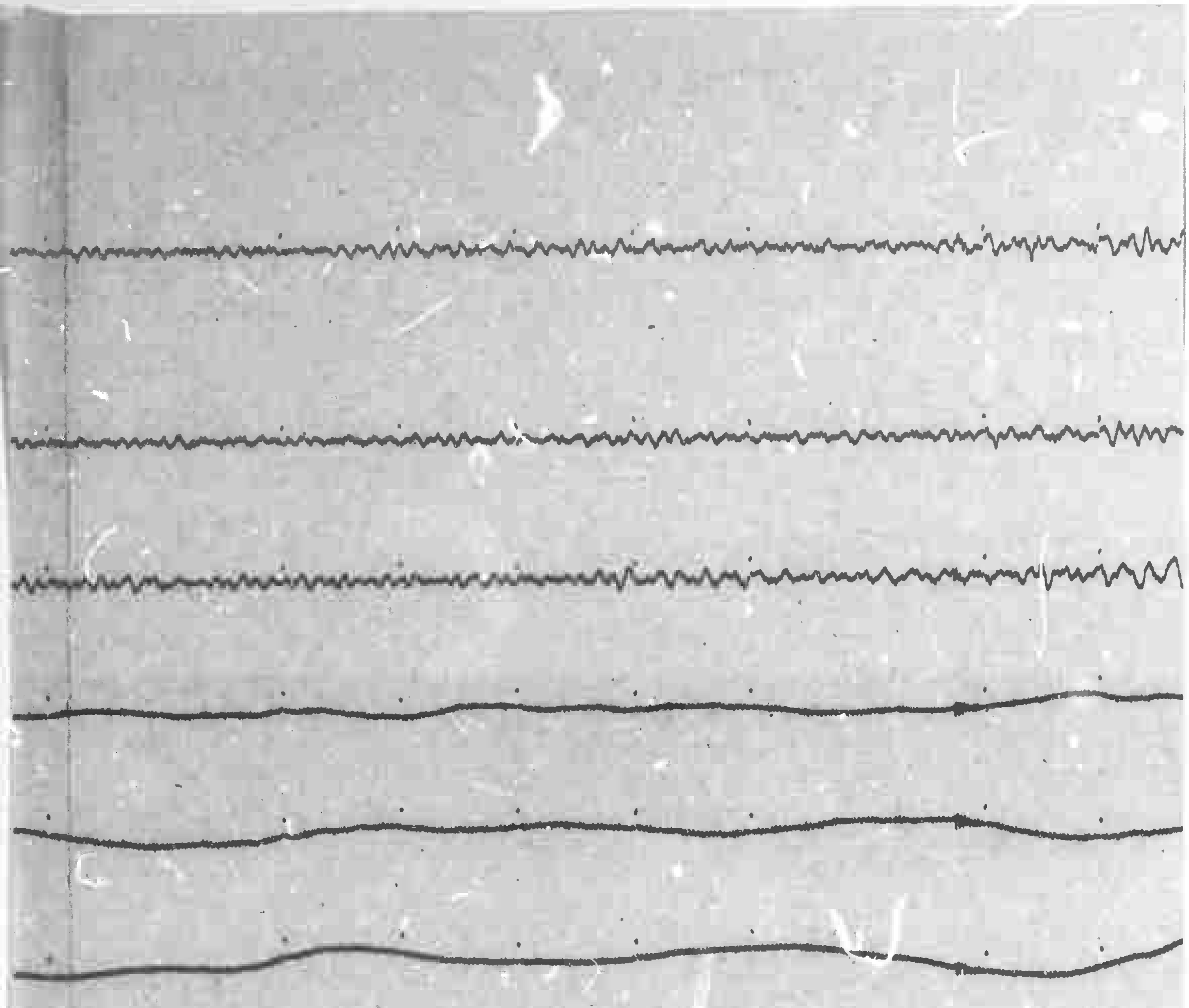

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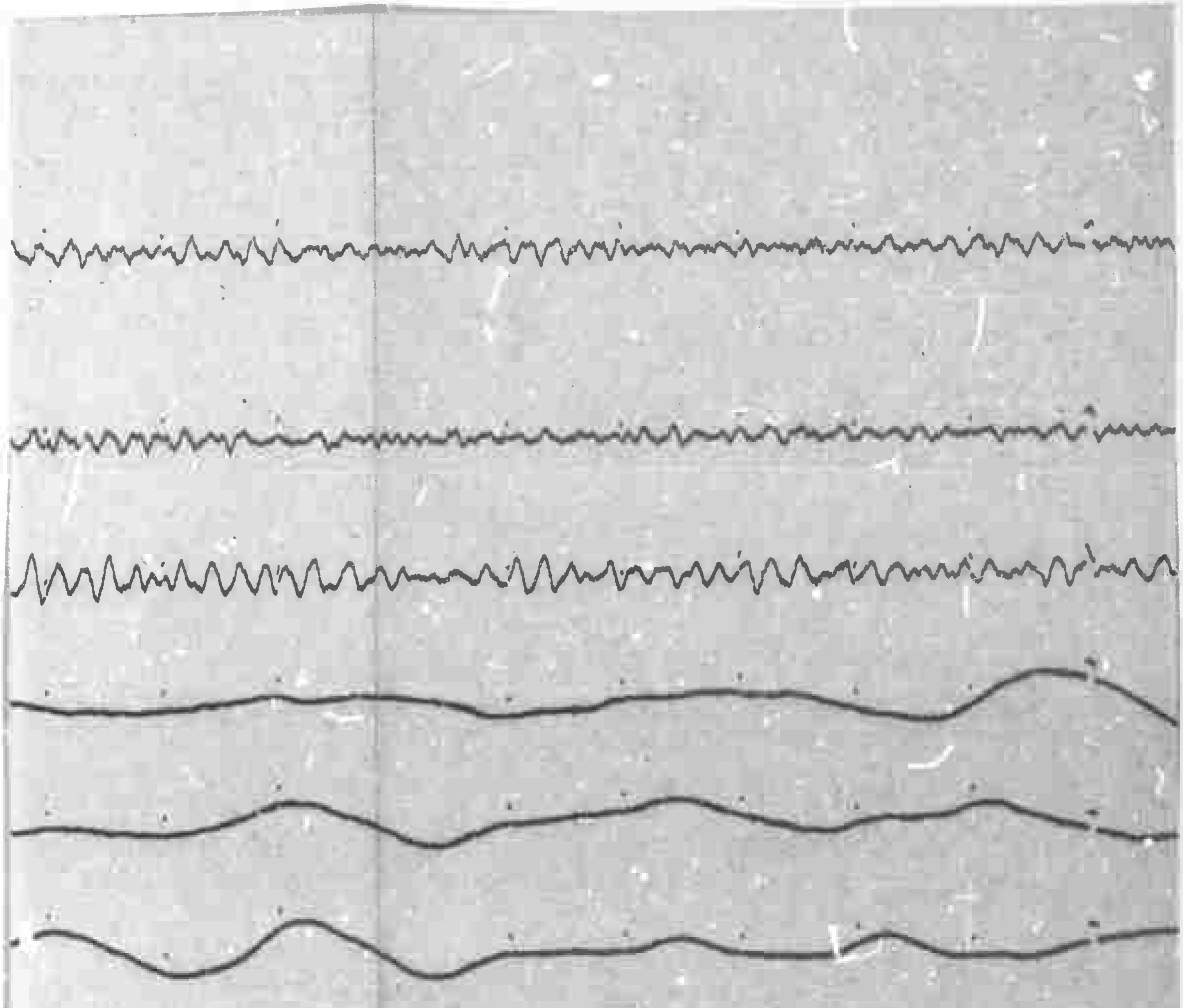

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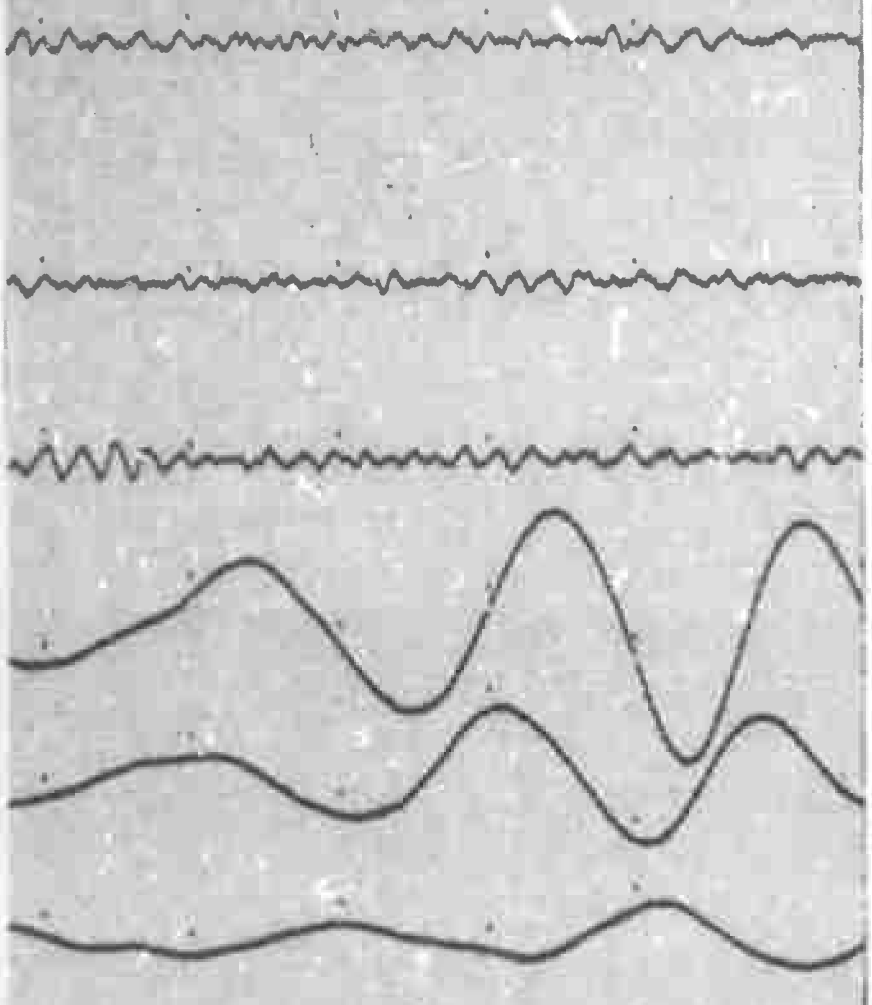

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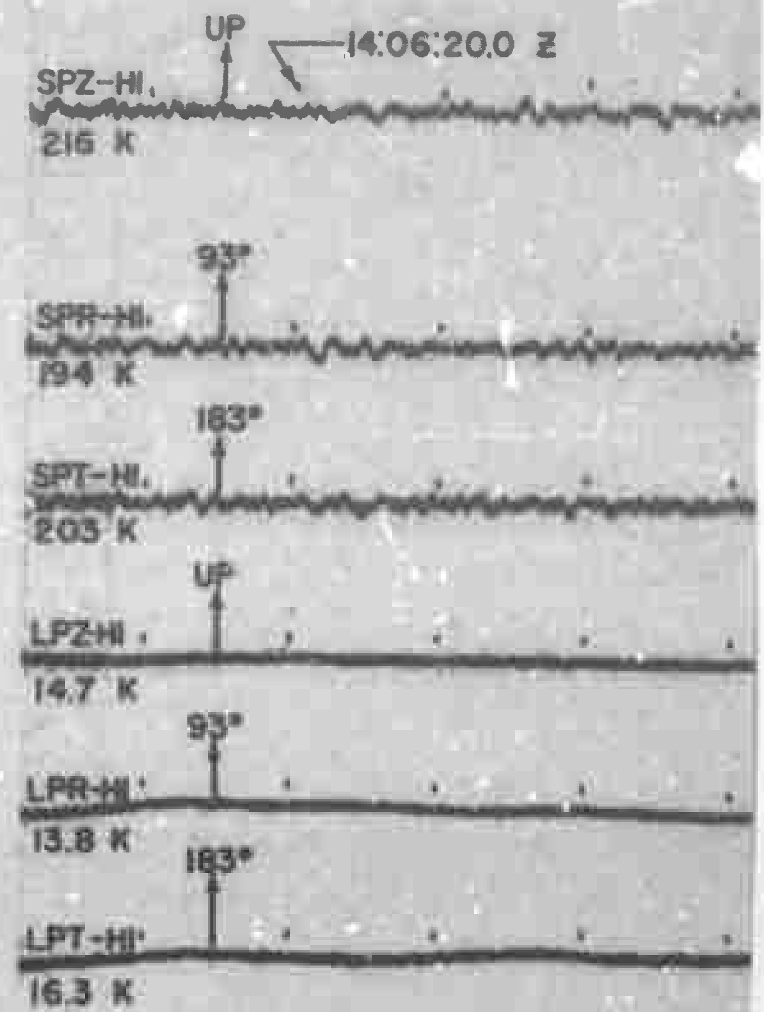
TAN

HN-ME

HOULTON, MAINE

03 JUNE 1966

Δ = 4066 km



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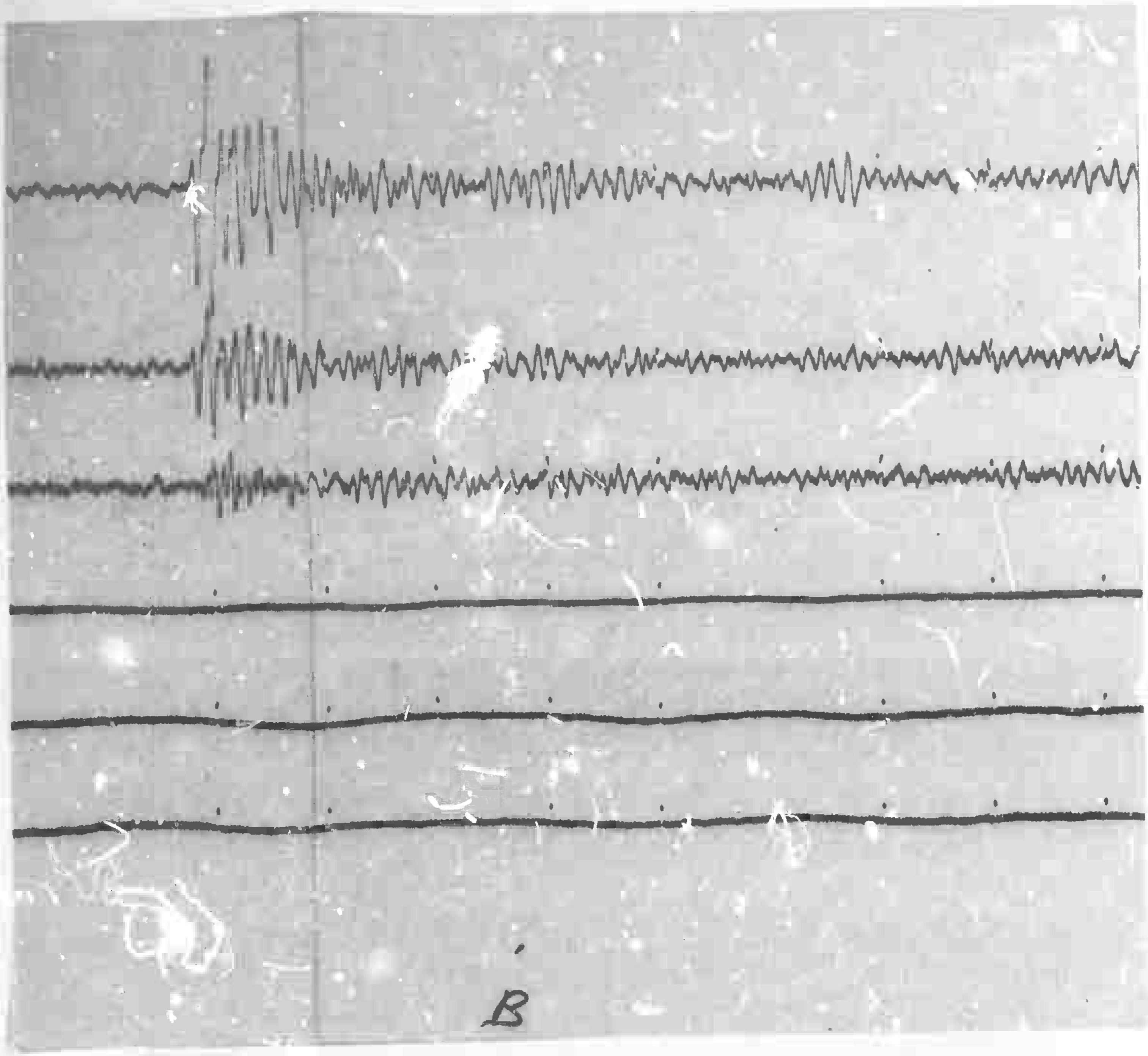
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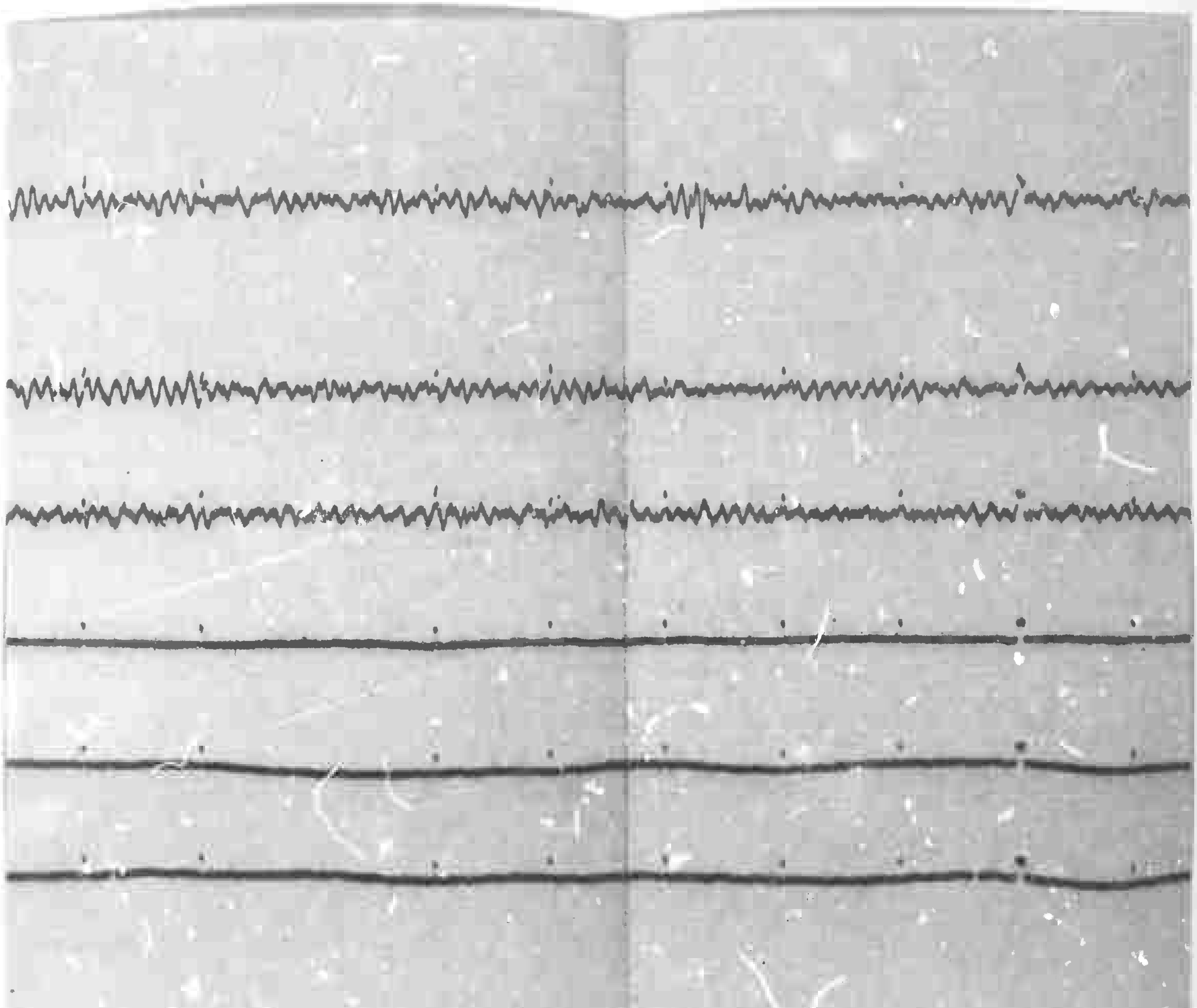

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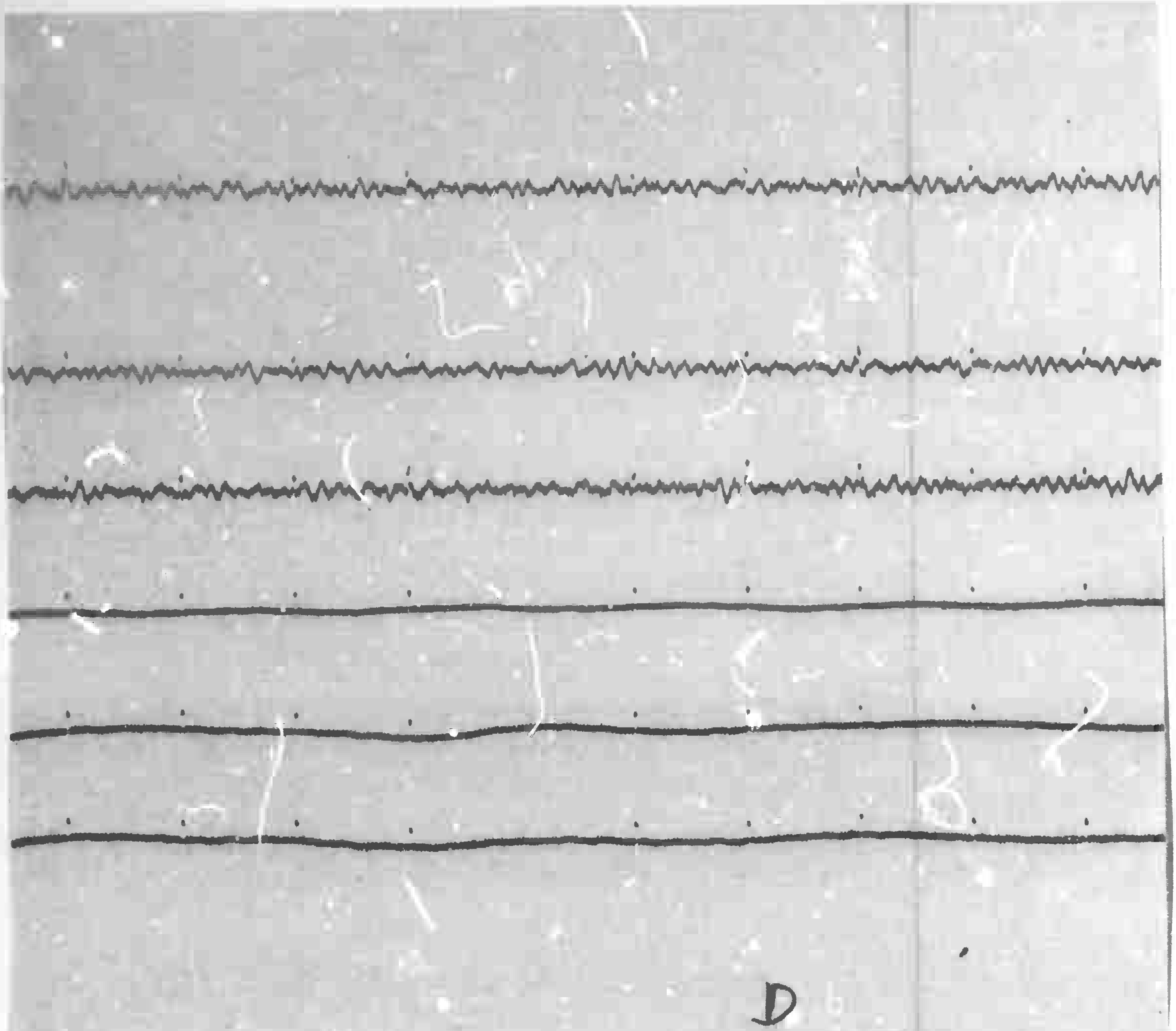
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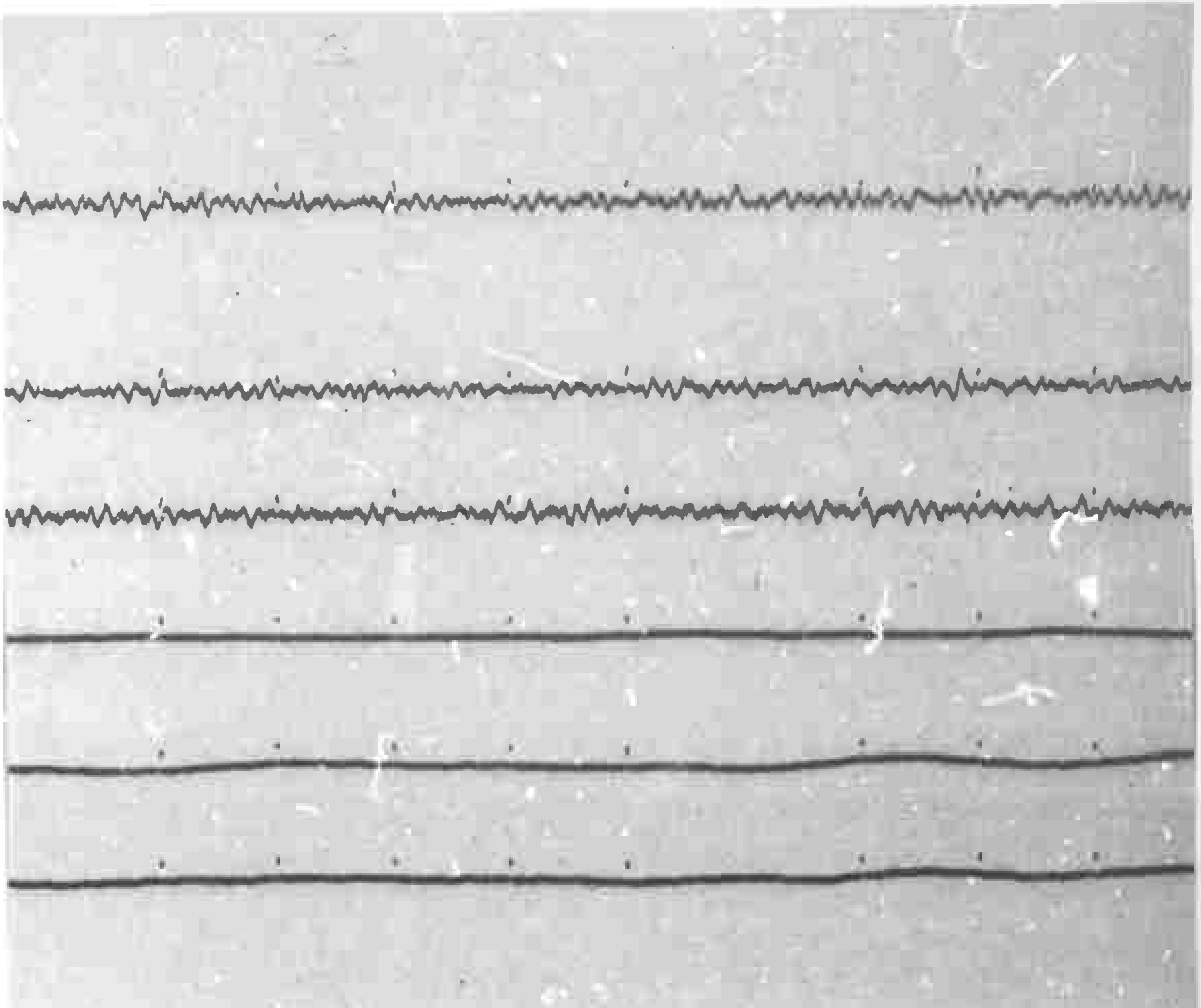

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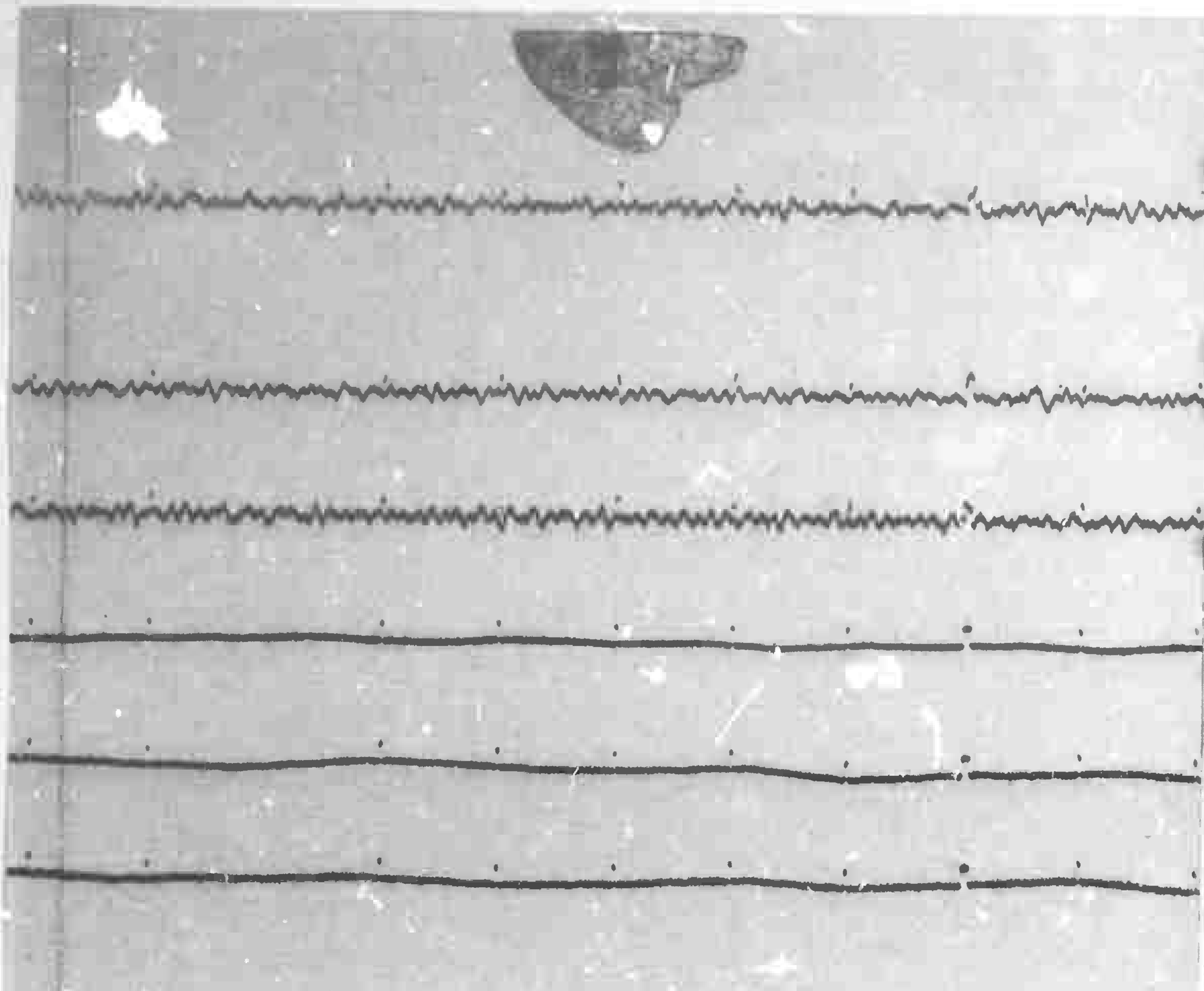

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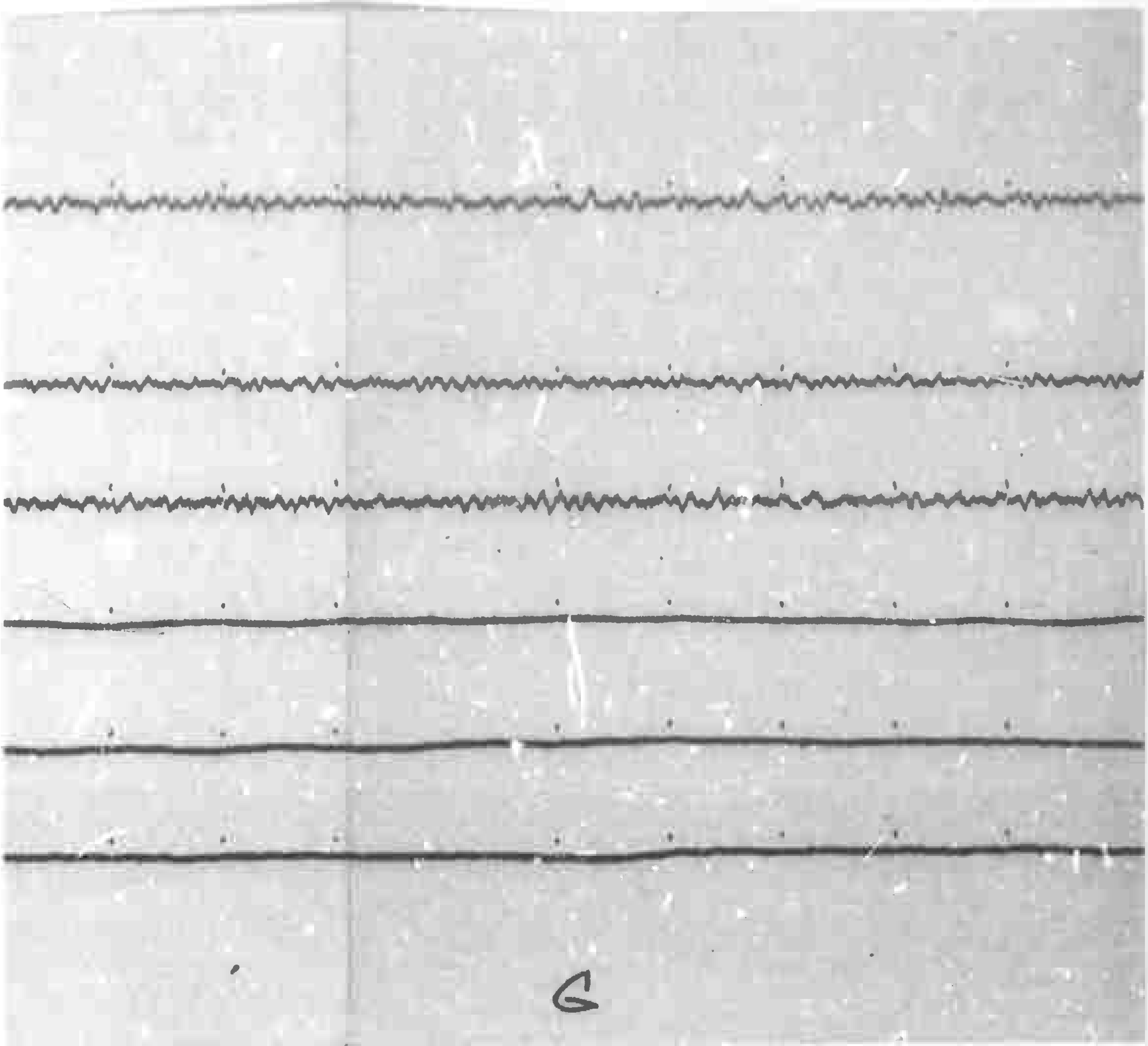
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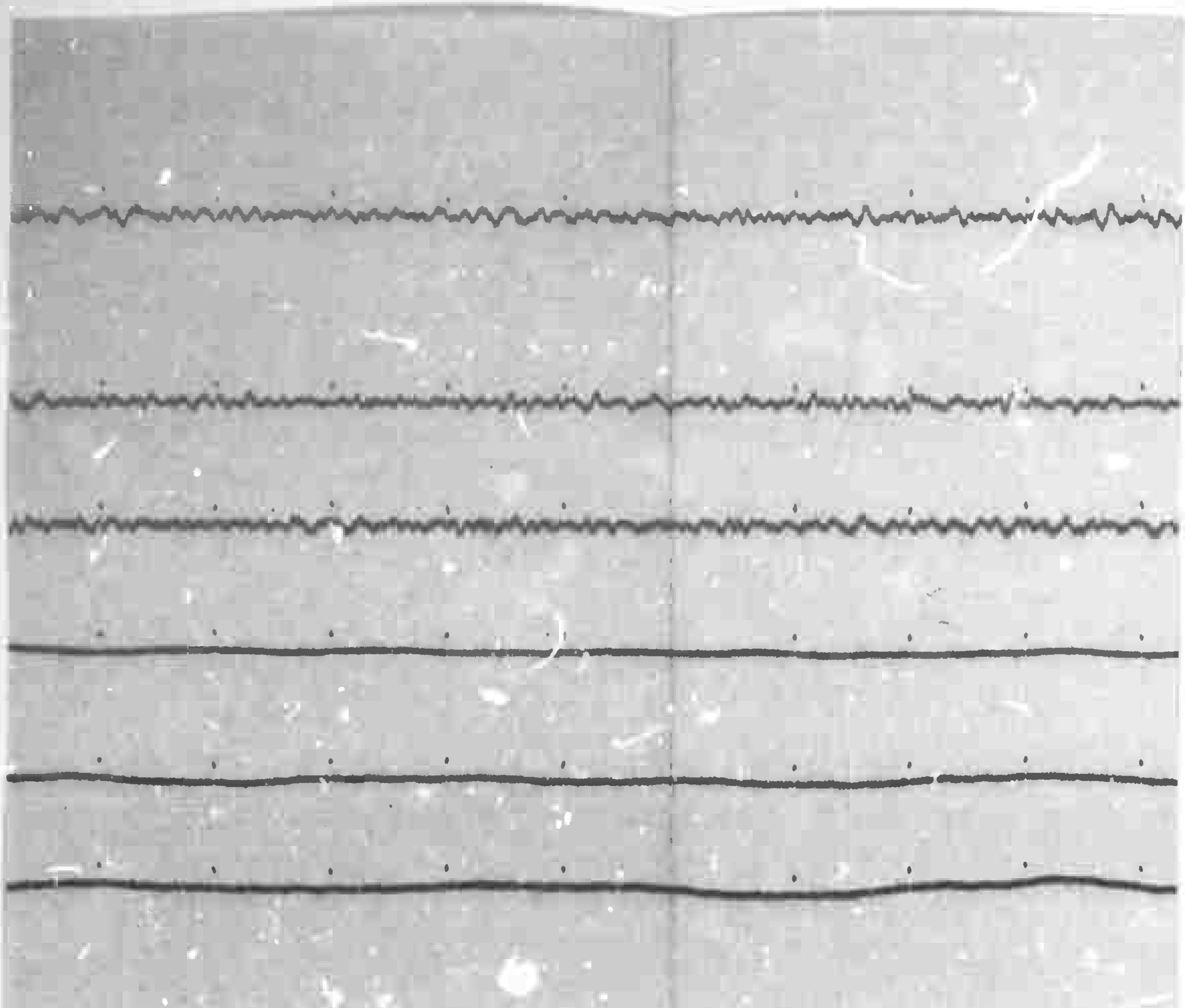

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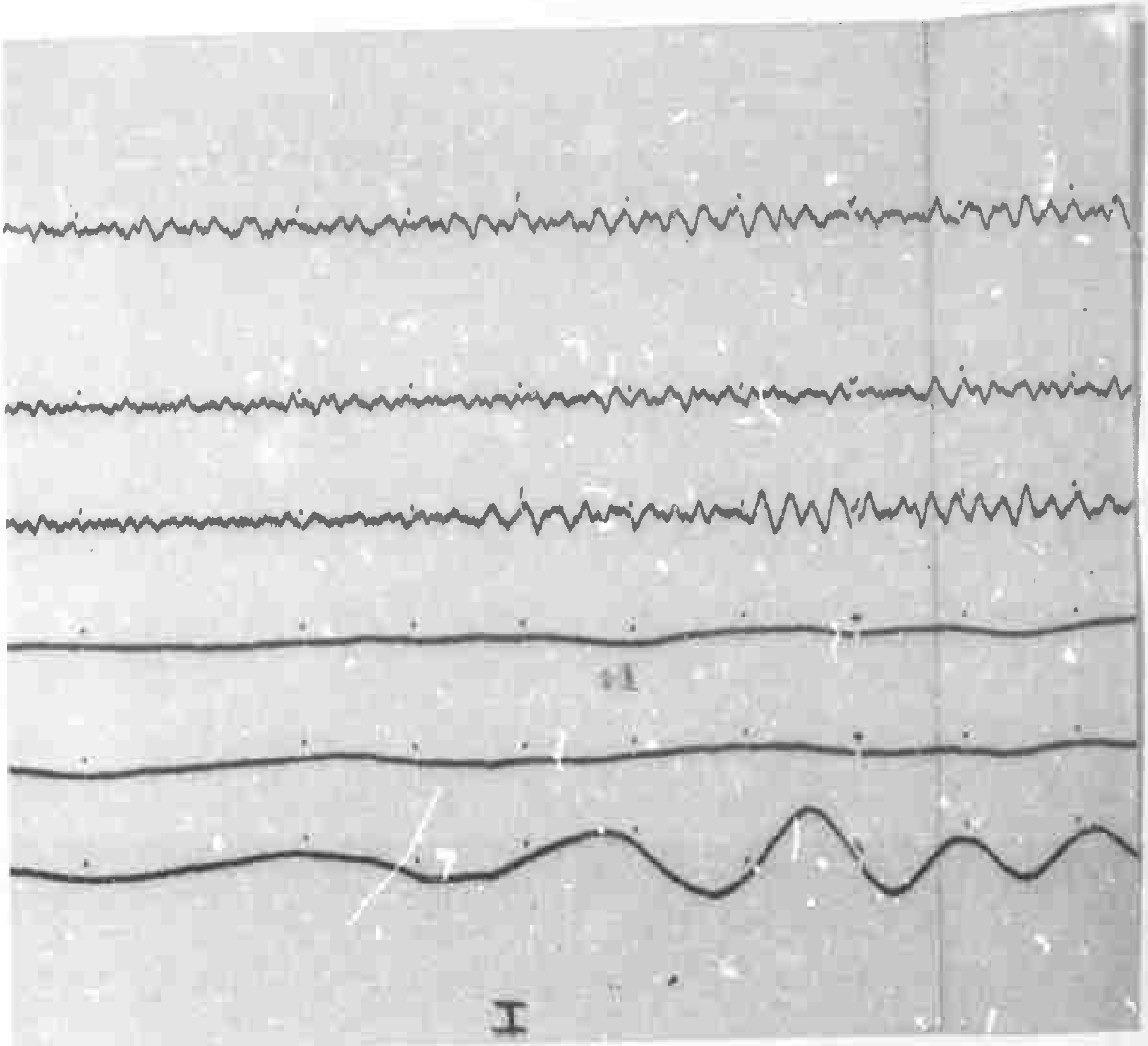
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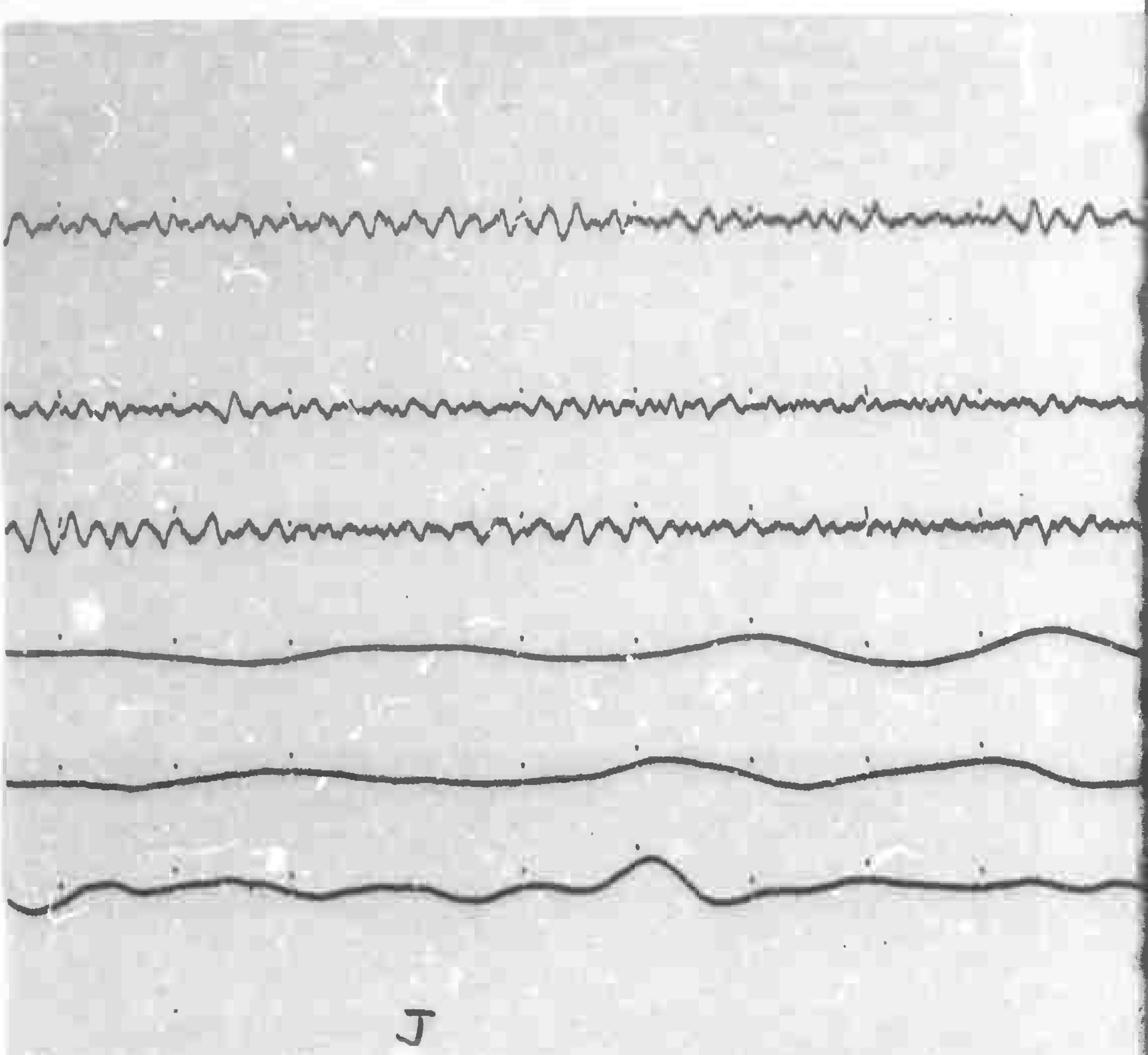
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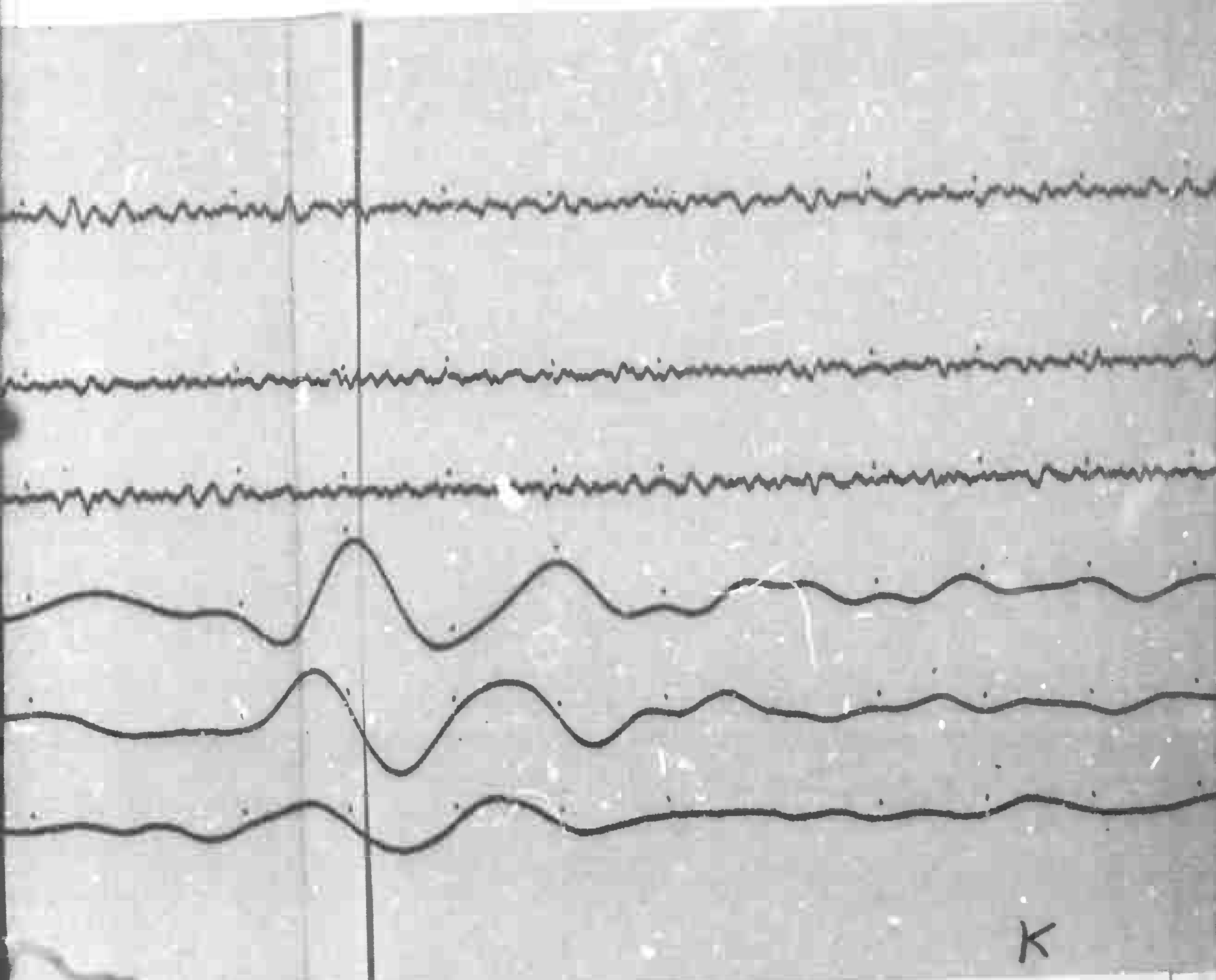
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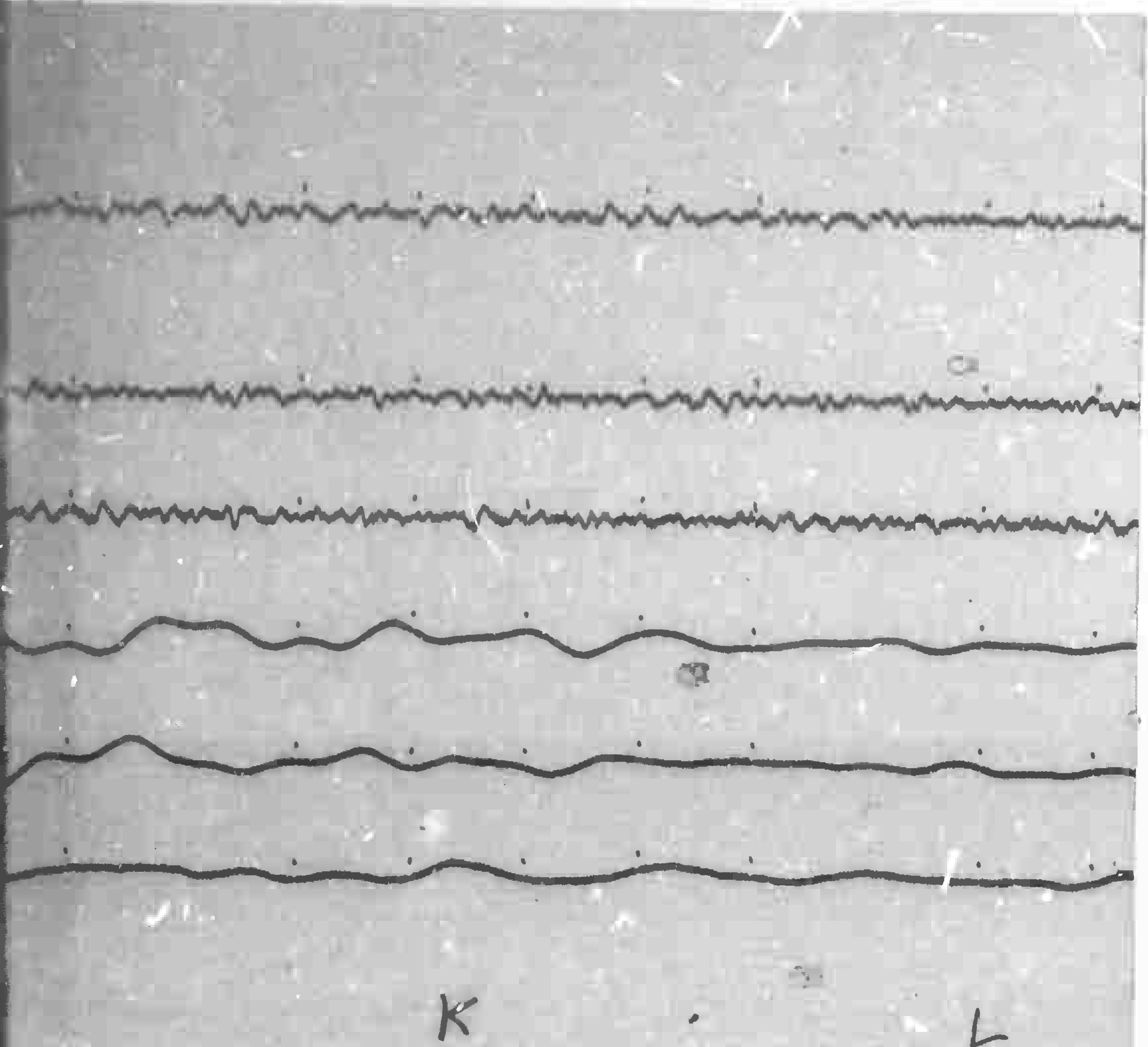
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